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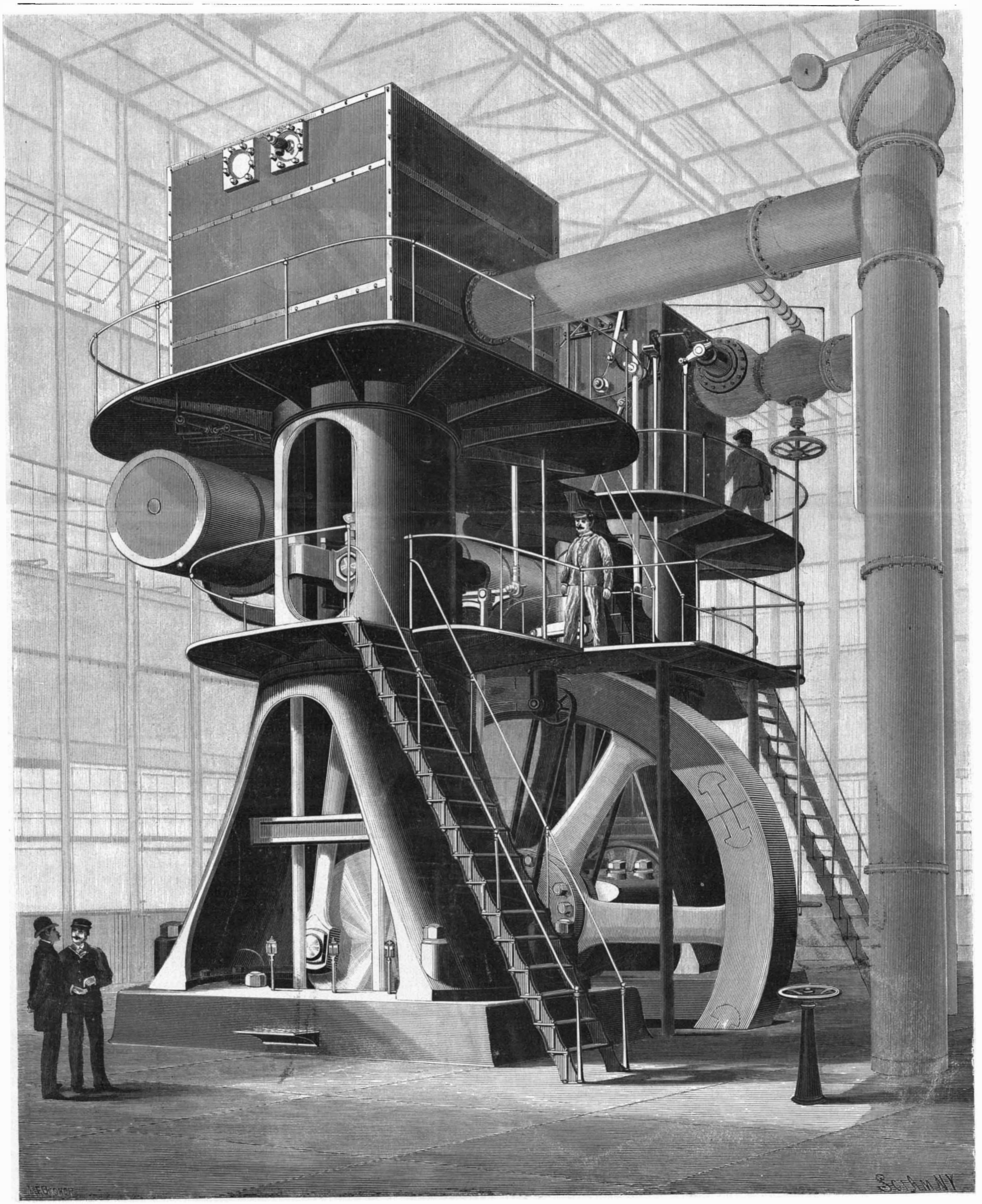

COMPRESSED AIR TRACTION IN NEW YORK CITY—1,000 HORSE POWER COMPRESSING ENGINE.—[See page 184.]

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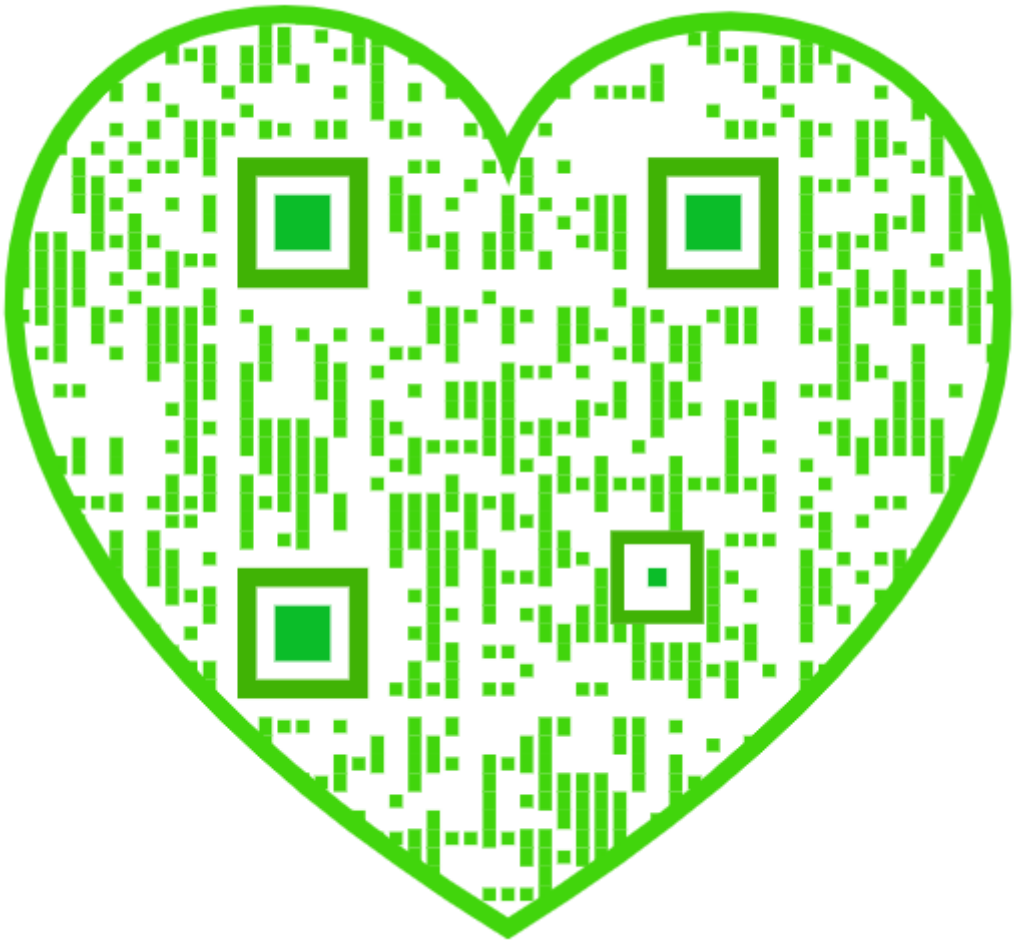

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NEW YORK, SATURDAY, SEPTEMBER 16, 1899.

RAPID TRANSIT BY THE GRACE OF THE POLITICIANS.

At last it begins to look as though New York city were to be provided with its rapid transit system, so sorely needed and so earnestly advocated by what is practically the entire voice of the press and the people. At recurring intervals in the past when everything has seemed ripe for the commencement of the work, the whole scheme has been discredited, cloaked, and spirited away from public view by one of those many dexterous, slight-of-hand performances whose secrets are known only to those within the innermost circle of municipal politics. For the past few months the question of New York rapid transit has been so utterly dead that it seems to have passed entirely from the public mind; yet suddenly, without any preliminary warning, the scheme is brought out again with much blare of trumpets and promise of speedy performance.

Amid all the rapid transit discussion that has been aroused, one looks in vain for a single new argument in its favor, or a solitary reason why it should be a greater necessity to-day than it was last year or in any of the long years that have passed since the question was first mooted. This most important municipal question has formed the subject of numerous articles in the SCIENTIFIC AMERICAN, which in common with the technical and general press of this city has pointed out the necessity for the system and the entire feasibility of the plans drawn up by the engineers of the Rapid Transit Commission. As a matter of fact, the arguments were long ago made, and to repeat them is to tire one's readers with wearisome reiteration. This great city needs rapid transit; it has asked for it; its engineers have laid out a feasible plan; it is rich enough to pay for it and there is not the faintest question as to its being at least self supporting, and yet with all these facts in its favor, the greatest municipal problem of the leading city in the new world is being made the sport of a few political adventurers, who seem to have the power to promote or delay it without the least regard for the urgent needs and expressed wishes of the citizens.

OUR FASTEST BATTLESHIP.

It is with great satisfaction that the SCIENTIFIC AMERICAN turns from the subject of our proposed slow-going cruisers to record the excellent speed that is being shown by our latest battleships. Last week we drew attention to the fact that the "Alabama" in a preliminary builders' trial had made an average speed of 16·3 knots over a 23-mile course, a maximum speed of 17·2 knots having been made with the wind and tide, and a speed of 15·43 knots against them. On this occasion the "Alabama" did not carry any of her guns, and a large amount of her armor had not yet been bolted on, so that she was probably from 1,500 to 2,000 tons short of her trial displacement of 11,525 tons. At the same time she was undoubtedly very foul as the result of being afloat for over a year at the Cramps' shipyard. It is reasonable to expect that on her official trial, with a clean bottom and under the favorable conditions of the best of coal and expert stokers, she will be capable of repeating the performance in spite of her greater displacement.

The good showing of the "Alabama," however, has been eclipsed by that of the "Kearsarge," one of the pair of fine battleships that is nearing completion at the yards of the Newport News Shipbuilding Company. This vessel has also been afloat for over a year, the date of her last visit to drydock being August 8, 1898, and on the occasion of her informal trial she carried the whole of her armor, together with the heavy guns of the 13-inch and 8-inch batteries, the only weights not carried being those of the 5-inch guns of the intermediate battery. Hence her displacement and draught were only slightly below what they will be at her official trial. Under these conditions the ship made by log during half an hour's steaming under forced draught a speed of 17·25 knots an hour.

The trial was made in water whose depth varied between ten and twelve fathoms, and it is a well understood fact (though only discovered a few years ago in the trials of some high speed cruisers) that a difference of fifteen or twenty fathoms in the depth of water on a trial course will have a very marked effect upon the speed of a deep draught warship. Hence it is reasonable to expect that when the "Kearsarge" is put in trial trip shape, she will be capable of maintaining an 18-knot average over the deep-sea trial course. If she does this, our latest first-class battleship will easily be our fastest, the "Iowa" coming next with a trial speed of 17·08 knots per hour.

WORK OF THE INDUSTRIAL COMMISSION.

The Industrial Commission, which commenced its autumn session on the 5th of this month, in Washington, is equally deserving of the title "Industrious Commission," it would seem. Having divided itself into various sub-committees, its work of gathering information of vital import has gone on continuously during the heated term, while the whole force of special stenographers attached to the commission have been equally busy preparing the testimony, thus taken, for the government printers. This will make a report, soon to be issued, of incalculable value in all matters concerning the industrial condition of this country. One of the first witnesses of chief magnitude to appear early at this session will be John D. Rockefeller, who, it is not unnaturally believed, is the possessor of much knowledge likely to be valuable to the commission. It is now proposed that the commission will visit Chicago, late in September, to investigate the so-called "Grain Elevator Trust" of the West. This is one of the trusts believed by many to be beneficial and a necessity if a foreign market for American cereals is to be maintained against Russian and South American inroads. As many, with socialistic tendencies, on the other hand, believe such maintenance of American supremacy should be furthered by federal bureaus and that the trust is, in fact, a detriment to the Western farmer, it is thought that the commission here enters upon one of its most vital lines of inquiry.

TRADE WITH OUR NEWLY ACQUIRED TERRITORIES.

The Bureau of Statistics of the Treasury Department at Washington has just given out a resumé of the export and import figures of the trade between this country and our newly acquired territories or temporary dependencies that is both interesting and encouraging to the friends of American commerce. Even in the reciprocity years of 1892 to 1894, in which the exports from this country in those directions were greatly increased, the totals were not as large as those of the recently ended fiscal year, with all its disadvantages of active warfare. To Puerto Rico our exports are nearly 25 per cent in excess of the average of the past decade; to Cuba they are nearly 50 per cent greater; to the Hawaiian Islands over twice as great; and to the Philippines more than three times as much. The exports to these islands made necessary by the support of our military establishments and by the considerable shipments in aid of the temporarily destitute are not included in these figures; they are only those of the legitimate increase of commerce. Naturally, as a result of war, and especially so in Cuba and the Philippines, the imports from these lands to us fell off very considerably during 1898; but the healthy resumption of trade relations is shown by a small increase as compared with last year in Hawaii; nearly 20 per cent in the Philippines; almost 50 per cent in Puerto Rico; and over 66 per cent in Cuba. These are most gratifying trade reports.

THE "SHAMROCK" AND HER CHANCES.

When the "Shamrock" poked her long nose through the early morning mists off Sandy Hook at the close of her fourteen-day trip across the ocean, it was found that if she embodied any striking novelties of construction they must be hidden away below the waterline or beneath the shelter of her canvas-covered aluminum deck. In her sail plan she is the typical English cutter, with such variations as always characterize the boats of Fife, her talented designer. The most notable features of the hull, or that part of it that can be seen, are the exceptionally high freeboard (between 5 and 6 feet) and the great beam of the boat at the quarters. The advantage of these features was evident in her preliminary trials off Sandy Hook, when she reached in a fresh breeze from Sandy Hook Lightship to the Scotland Lightship, a distance of 4⅛ miles, in 19 minutes and 10 seconds—a speed of 13 knots—without putting her lee rail below the water. Like the "Vigilant," she appears to be at her best when sailing "on her uppers." On the same day, when close-hauled and sailing within four points of the wind, she made by log a speed of just under 11 knots an hour, and before the wind her speed by log was a trifle over 12 knots.

Now, in judging of these performances, which may be taken as reliable, it must be borne in mind that the yacht was not carrying her racing canvas, that her bottom has not been cleaned for nearly two months, and that she gave the experts who were watching her the impression of having a considerable reserve of power, even at the high speeds of twelve and thirteen knots. The preliminary trials establish the fact beyond question that in "Shamrock" we have to meet a boat that is remarkably fast in fresh to strong breezes.

In her trials in a light breeze, on the other hand, the visitor failed to make such a good impression, and seemed to lack that ability to slip away at the first suggestion of a breeze which is such a conspicuous feature in "Columbia." This may be accounted for in part by the possible foulness of her bottom, which, while it would not greatly affect her speed in a fresh breeze, would retard her greatly at slower speeds, where wave-making ceases and skin-friction becomes the chief element of resistance. But though the larger sailspread which she is to carry will also increase her light weather speed, the present indications strengthen our impressions, formed from her races with "Britannia," that "Shamrock" is not by any means a light-weather boat.

Curiously enough the conditions appear to be reversed, if anything, in "Columbia," for while she is practically held by "Defender" in a fresh breeze, she begins to walk away from the older boat with an excess of speed which steadily increases with the lightening of the wind.

The present indications are that on days when the winds are light or of moderate strength "Columbia" will win by a comfortable margin; while on days when the winds are fresh to strong the "Shamrock" may be the first to finish, particularly over a triangular course. We base this conclusion on the facts that in crossing the Atlantic under reduced rig, the "Shamrock" on one occasion covered 288 miles under her own sail in the twenty-four hours in a rough sea. This is an average speed of twelve knots an hour, and the performance certainly suggests that in the smoother seas off Sandy Hook, with a clean bottom and racing canvas aloft, and in a whole-sail breeze, she could reach around a triangular course at a speed of 13 to 13½ knots an hour.

But we must remember, on the other hand, that the very features which enable the boat to "carry on" in a blow will hold down her speed in light airs; and the experience of the past decade on the Sandy Hook courses proves that on five days out of seven in October the winds will probably be light. Hence it looks as though the cup were likely to stay on this side of the water for at least another twelve months.

ARTIFICIAL SILK.

The production of artificial silk has for some time past attracted the attention of experimenters in France, and it has been used with success to replace natural silk in certain fabrics. The Count du Chardonnet, who claims to be the first to have successfully carried out the process, exhibited some fine specimens of artificial silk at the Paris Exposition of 1889. Since then he has perfected his system, and at the present time a factory of considerable importance is in operation at Besançon, under the direction of M. Tricano. This factory is now capable of producing 150 kilogrammes of artificial silk per day.

Natural silk is largely made up of a body called "fibröin," together with other substances such as gelatin, albumen, wax, coloring matter, fatty and resinous matter, etc., the cellulose of the mulberry leaf being thus transformed by the silkworm. The nature of these transformations is of course unknown, and in order to produce a substance resembling silk, a method is adopted by which the cellulose furnished by cotton is used as a base. The cotton, having been transformed into nitro-cellulose, or guncotton, by treating it with nitric and sulphuric acids, this latter is dissolved in a mixture of ether and alcohol, and the resulting collodion is filtered under pressure.

In order to be successfully used for the production of artificial silk, it is found that the collodion must be allowed to "age" for a certain period of time, the reason of which has not been definitely settled: however, it is certain that the collodion, on being allowed to stand, undergoes certain modifications by which it is better fitted for the purpose. It is then run into cylinders, which have capillary holes in the bottom, and the collodion is forced out of these holes under a pressure of forty to fifty atmospheres. It comes out in the form of white cylindrical filaments; these are united to form threads, which are put up in skeins and all traces of alcohol or water which they may contain are removed. In this state, however, the threads are extremely inflammable, partaking of the nature of guncotton, and to remove this difficulty they must be "de-nitrated," that is to say, the cellulose must be brought back into its normal condition. This part of the process, which is indeed an essential one, involves considerable difficulty, and has been experimented upon for some time by M. du Chardonnet and others. However, a process has at last been arrived at which accomplishes this in a satisfactory manner. The details of this process have not as yet been made public; but it is certain that by this operation white silky threads are produced, which are not appreciably more inflammable than natural silk. The skeins which have been made up of these threads are then dyed by immersing them in a heated bath of basic aniline color.

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LIQUID AIR AS AN EXPLOSIVE.

BY FREDERICK H. M'GAHIE.

In a recent number of the SCIENTIFIC AMERICAN SUPPLEMENT, there appeared an article by me in which the claims of liquid air to employment in the explosive world were examined, with the conclusion that it had little to recommend it. It was pointed out that its theoretical value lay in the fact of its affording a source of highly condensed oxygen, and that, on account of the lower boiling point of nitrogen, liquid air could be profitably concentrated to a point where the percentage of oxygen ran from 50 to 75 per cent. The mixture of this oxygenated fluid with a proper combustible gives a powerful and simple explosive capable of detonation. It was further pointed out that the volatility of the liquid precluded its use in all but the large contracts where a liquefying machine could be installed as part of the contractor's plant. Even here, the practice generally accepted in blasting work as conducive to economical results, that of firing a large number of holes at once, put it out of consideration, since a delay in firing at once a hole, after charging with a liquid air explosive, entailed an amount of evaporation that was fatal. How this limitation entered into the problem was illustrated by the unsuccessful trial of the system at a coal mine in Europe, where prepared cartridges standing fifteen minutes lost all or nearly all of their explosive power.

This oxygenated fluid is receiving another trial in Europe under conditions meeting its limitations as far as possible. The facts have been communicated to me by an eminent expert on explosives who has recently returned from Europe, and will be undoubtedly of much interest to the readers of this paper. Work is progressing simultaneously at both ends of a tunnel that is being put through the Alps. On the southern side the usual explosives for hard rock, blasting gelatine and gelatine dynamite, are being used. On the northern side liquid air is being tried with concessions to its characteristics that afford it every chance of demonstrating any value it may have. In the first place, one hole, or a few at the utmost, are charged and fired at a time. This reduces the time in which the oxygen has a chance to evaporate, the method of charging a hole being in addition very simple and rapid. A cartridge containing the combustible element in a form permitting rapid absorption of the liquid is slipped into the hole, the oxygenated liquid poured into the cartridge, a cap with fuse put in, a light tamp inserted, and everything is ready for lighting the fuse. However, the firing of single holes means increased expense in the item of total idle time of the men during the explosions for a given amount of work. In the second place—and the most important side of the matter—much larger boreholes are being employed than are found advantageous with the nitroglycerine explosives.

The problem in blasting work is generally to dislocate, per pound of explosive, the greatest possible amount of rock in fragments convenient for handling and removal. If the blasted material is to be used specifically for any purpose, blasting conditions must be varied to give it in the desired sizes. Now, the character of the material determines the explosive to be used. In earth work the dynamites are outclassed by black powder, which develops its pressure comparatively gradually and dislocates or disturbs a large amount of earth, while the sharp action of the dynamites leads to compression of the material around the charge and strong wave movements in the total mass, but gives little useful work. In rock of any degree of hardness the reverse is true.

Here the black powder calls for tamping of fissures and boreholes to the extent that they are not the weakest points. The rock is removed in large masses, needing further breaking up. The dynamites do not require such heavy tamping, since they detonate and tend to crush the rock into small fragments. In the range from the soft to the hardest rocks there arises a similar need for variation in the action of dynamites, which is met by the admixture in various proportions of nitroglycerine with inert bodies, combustibles, or oxygen-bearing salts, alone or together. Such admixture not only changes the force but varies the sharpness of the explosive blow. The softer the material in which work is being conducted, the greater the need of an explosive giving a pushing rather than an impulsive shock. An apparently strange fact is that wet guncotton has a greater shattering effect than dry guncotton. Though wet guncotton has the lower explosive force, the detonative wave is propagated more rapidly in it, giving a sharper and consequently more destructive blow. This will illustrate why the various grades of dynamite have different effects. So it may be that liquid air explosives combine power and degree of sharpness of detonation in such a manner as to be well adapted to the hard rock met in this tunnel. The explosive employed should certainly have as high a strength as the gelatine dynamites. Being a mechanical mixture of combustible material, it would seem that it should not detonate as sharply as the gelatine dynamites. These conditions would seem to indicate that the borehole could be economically enlarged. But the results of long experience must settle the matter, especially the question as to what extent can a supposed decrease of blasting expenses under favorable conditions counterbalance the many disadvantages involved in such a volatile explosive mixture. It is apparent that operations must run very smoothly and everything held subordinate to exploding the charges as soon after the holes are ready as is possible. Now, delays must occur, and a weakened charge may produce undesirable effects, such as enlarging the borehole.

A Linde machine is made use of. Another point of interest is that a heavier cap than usual is required.

However, the phase of the question upon which these experiments bear is not the value of liquid air for general blasting work, but its value for certain classes of work under special conditions. The parties from whom the information came originally claimed success, but, as they were interested in the matter, the statement must be taken with the usual grain of salt. The history of explosives is full of wonderful compounds that perished prematurely through a thorough trial. I have in mind a non-freezing dynamite that was going to revolutionize things a few years ago. It strangely blossomed in summer time, when it proved part of the claims made for it, that of strength. Naturally, since it was a powerful dynamite, the first frosts wilted it badly. In most profane language irate contractors began asking what kind of a non-freezing dynamite was one that froze quicker and more hard than their old friend, and in addition "busted" the cases and became very coy about exploding after being thawed out.

SCIENTIFIC CONGRESS AT COLUMBUS.

BY DR. HORACE C. HOVEY.

Resuming my review of the American Association for the Advancement of Science meeting:

Dr. Howard read a paper about "Gad Flies," in which he detailed the experiments of a Russian entomologist, who killed enormous numbers by means of a kerosene film spread over the pools in which they are known to breed. He claimed that previous to these experiments of Porchincki, he himself had tried a similar method for the destruction of mosquitoes, and had called attention, in 1892, to the fact that many gad flies were thus captured.

A wonderfully interesting communication concerning the blind fish, and other blind cave animals, was read in the section of Zoology, by Prof. Eigenmann, of the Indiana State University, of which it is hoped to give a more full account in a future number of this journal. The A. A. A. S. was so impressed by this able and learned paper as to appropriate the sum of one hundred dollars to aid in Dr. Eigenmann's further investigations into subterranean life, and its bearings on the theory of evolution by environment and compensation.

Dr. Washington Gladden, of Columbus, read a paper concerning the moral tendencies of the system of industry now prevailing, which he also reproduced in his own church the following Sunday. It showed that while we may never secure a perfect morality through improvement in the social mechanism, we may establish social conditions which shall be more friendly to morality than those that now exist. Prof. H. H. Newcomb, of Washington, D. C., discussed "Trusts," showing their dangers and also exposing certain popular fallacies about them that actually hindered reform in the relations of capital and labor. He held that capitalistic combinations perform a useful public service; the field of legitimate inquiry being as to the proper distribution of their beneficial results. Such so-called "trusts" should tend to decrease prices to consumers, increase the demand for materials, augment wages, and ameliorate the condition of employes. Miss Florence Kelley, of Chicago, likewise read a paper bearing on the labor question, in which she narrated her personal experiences in trying to reform flagrant abuses in workshops, factories, and stores and her methods of securing the enforcement of salutary laws. The results appear to have been very beneficial. She is the daughter of Congressman Hon. Wm. Kelley, of Pennsylvania, famous for his expert knowledge of the iron trade.

These are only a few of the two hundred and seventy-three scientific papers discussed, and others might be regarded as equally worthy of mention. The more important addresses and papers will appear in the annual volume of the associational proceedings, while others will be given by abstract. Thus year by year a scientific library has grown up, whose contents have a value that can hardly be overstated, embodying, as they do, the history of learned researches in all departments for the last half century.

Evidently the visiting scientists and their hosts of Columbus were on the best of terms. Everything was done to make the forty-eighth meeting of the A. A. A. S. memorable for hospitality as well as for scientific interchange of experience and discovery. Besides the more general entertainments, nearly every section and affiliated society had its supper, or trolley ride, or other excursion. Those who had never previously seen the flames of the natural gas region were astonished and dazzled. Others rambled through the woods and fields for plants, or insects, or other specimens of natural history. The geologists took a day for the coal mines of Corning and Hollister, where they found mines worked by electricity and lighted by the same means, visited a subterranean forest of the Carboniferous Age, said to be the finest of its kind, and enjoyed the novelty of dining by electric light 200 feet underground and a mile from the daylight. These mines are owned by the Sunday Creek Coal Company and the Courtright Coal Company. The visitors noted with interest the beautiful plant impressions, the ferns, calamites, cordaites, and Sigillaria tessellata. There are 500 oil wells also in the Corning field, the oil being all derived from the Berea grit, at a depth of about 1,200 feet. The gas wells near Thurston are 2,000 feet deep and derive their gas from the Clinton-Medina formation.

A grand excursion was made at the close of the meeting to Sandusky, Kelley Island, and Put-in Bay, at which place they explored the unique and marvelous Strontia Cave, the only one of the kind known. The arches are hung with prismatic crystals of "celestite." The place was found by Mr. Gustave Heinemann, in 1897, while opening a well. Besides exhibiting his grotto, he makes money by selling specimens of the sparkling strontia. Commercially this mineral is worth $12 a ton, and is used to clarify beet sugar, and likewise in pyrotechnics, giving a vivid crimson color to fireworks.

An excursion to Macinac and the lakes was enjoyed by a number. An anthropological party visited Fort Ancient, an extraordinary prehistoric stronghold, located on the old Lebanon and Chillicothe turnpike, between Columbus and Cincinnati. It is my intention, however, to give a future article expressly on this extremely interesting and mysterious fortification.

Three cities contended for the distinction of entertaining the meeting in 1900, namely, Denver, Philadelphia, and New York. The latter won the day. The date was set in June, from the 25th to the 30th, in order to favor members who may wish to attend the Paris Exposition. The president for 1900 is Prof. R. S. Woodward, of Columbia University, an alumnus of the Michigan University, distinguished for his services in astronomy, geodesy, and mathematics. He has for many years been the treasurer of the A. A. A. S., and is the president of the American Mathematical Society, and also a fellow of the National Academy of Sciences. A pleasant incident of the closing meeting was the gift of $1,000 from Mr. Emerson McMillin, of New York, but formerly of Columbus. This places him as the fourth patron of the association.

AUTOMOBILE NEWS.

Chief Croker, of the New York Fire Department, has decided to use a gasoline automobile for going to fires. He finds that the two horses which he keeps to take him to fires are unequal to the duty imposed upon them. The new carriage weighs about 400 pounds.

An automobile has made the ascent of Mount Washington, 6,300 feet above the sea level, in two hours and ten minutes, the distance being ten miles. This included delays in replenishing the water tank. The time was, however, about half that required by the teams that make the trips with carriages. The carriage was driven by F. O. Stanley, of Newton, Mass.

According to The Wheel, there are probably over a dozen French firms who have been able to cope with the enormous demands made upon them for automobile vehicles. They have accomplished this by laying down costly plants equipped with American machine tools and attracting the best mechanics into their shops by paying them high wages. Each of these concerns is turning out motor carriages of the standard types by the score. They continue to work from set patterns and are not disposed to change them. Others who possess fairly satisfactory vehicles cannot manufacture them on a commercial scale either because they lack sufficient means or are unable to get a sufficient number of hands. As in this country, there is also another class of small makers; these are the men who are inventing and perfecting motor carriages, and who build one from time to time.

A recent consular report from Consul-General Goodnow gives an amusing view of Chinese character. He says that it is impossible to sell anything to Chinese which they have not seen. Automobiles are the point in question. They have never seen them, and they cannot imagine what they can be like. Naturally, the average Chinaman has seen so few new things that it is not easy for him to exert his imagination. Makers of automobiles will find that it is useless to attempt to sell carriages to Chinese or foreigners by means of descriptions or catalogues. It is proposed that ambitious dealers make a present of an automobile to some well known person in Shanghai, making him promise to use it constantly and prominently, so that the Chinese may become accustomed to the startling innovation. The place is an ideal one for motor carriages, the roads are macadamized and the climate very fine.

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JIG-FILE FOR FINISHING DIES.

The accompanying sketch was made by our artist during a recent visit to the works of the American Waltham watch factory. It represents one of the thousand-and-one handy and ingenious machines with which the factory is crowded. Everyone who has handled a file at the bench knows how difficult it is to file a surface that shall be perfectly plane or exactly normal to some other surface. No hand is so steady or eye so true but inequalities or variation will occur. In the jig-file herewith shown the operator is finishing up some of the fine dies which are used in the factory. The file is carried in a vertically sliding head, operated by a crank and connecting rod below. It projects above a plane cast iron table, upon which the die is

JIG-FILE FOR FINISHING DIES.

firmly held down, and at the same time brought up with suitable pressure against the file. The machine is driven by belt and pulley and requires no manipulation after it is once started, the workman being able to direct his whole attention to bringing the die to the required shape. The table is capable of being set and clamped at any desired angle according as the edges of the die are to be square or at an angle with its face.

A LARGE OCTOPUS.

BY PROF. C. F. HOLDER.

One of the most disagreeable animals of the sea to handle or contemplate is the octopus. The tangle of arms, the snakelike movements, the strange flashes of color, the green glittering eyes, are all features that arouse a strong feeling of aversion on the part of the observer. I have had under observation several octopi at the Santa Catalina Aquarium and it has been interesting to note the characteristic features of the various individuals. In a small tank were confined three individuals having a radial spread of perhaps 18 inches. One affected a light yellow hue and was timid, sulking behind a rock. Another, of a dark reddish cast, was continually flourishing its tentacles, rising and falling on the side of the glass until an observer nicknamed it the "skirt dancer." A third was almost black, and was a vindictive fellow, ready at any time to make an attack. When I introduced my hand into the tank, this octopus would as quick as a flash send out one long attenuated tentacle and coil about it, then if an advance was made it would suddenly release its hold upon the rock and quickly encompass my hand with its eight arms, pressing the round serrated disks into the flesh while a tremulous motion would be felt.

At the first attack of this kind the sensation was one of horror. The hideous creature flattened out, assimilating the color of the flesh to a marked degree and evidently endeavoring to smother the hand with its folds, as the tentacles were distended to their utmost limit. To hold the hand firm under such circumstances required some effort, and I confess when it was first attempted, with a Florida specimen, I beat a rapid and decided retreat; but in the latter case I waited to see if the animal's object was to bite, knowing that the bill of so small a specimen could not make a serious wound. But the octopus merely pressed its mouth on the back of my hand, apparently trying to intimidate the supposed enemy. While fastened to the hand, it still held to the rock, and it was with difficulty released. When I remained quiet, the animal began to creep along like a huge spider, but at the first movement of my fingers it pounced upon my hand again, enveloping it in the eight snakelike arms. I finally twisted out of its grasp and seized it firmly by the body, when its rage became intense. Flushes of color passed over it in rapid succession; now red, black, yellow, and when at the height of its anger it was mottled and splashed with black—a frightful creature. It made a desperate effort to escape, but when released ejected a cloud of ink, darting off rapidly under its cover.

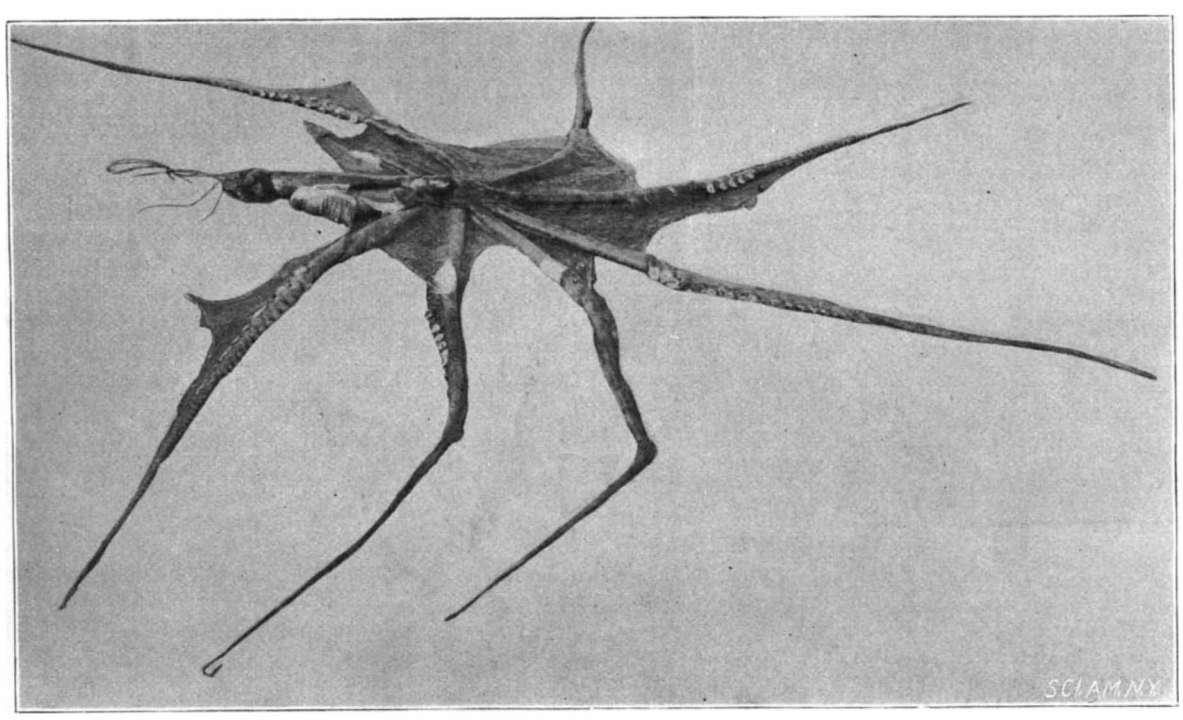
This octopus resented any intrusion and advanced to the attack at once. When a strange octopus was placed in the tank, although much larger, it came out of its corner without hesitation, eyed the newcomer a moment, then in some incomprehensible way literally hurled itself at the enemy, and in a second the two were rolling over and over in a contest that was amazing to witness. The sixteen tentacles wound about each other with the rapidity of light, and both animals ejected the inky fluid from their siphons. They resembled a ball of snakes rolling along and striking at each other more than anything else. A close examination of the writhing mass showed that the object apparently was to smother the opponent. Finally, the newcomer beat a retreat; it was badly wounded, and succumbed a few hours later.

The octopus is a favorite subject with popular writers on natural history, and many accounts have been written of its ferocity, which are almost invariably denied by naturalists; yet I am inclined to think that in some instances certain individuals are more or less pugnacious. I have handled scores of them from the Gulf of Mexico and California, and observed only one instance—the one cited—where the animal deliberately rushed to the attack, though I know of two others. One was observed by Mr. Ralph Arnold, a geologist, of Pasadena. He was wading among the pools at low tide at Point San Pedro when suddenly he heard a cry and turning saw some children in a pool, wading, and moving toward them a large octopus, its long arms raised above the water. Whether the animal would have attempted to attack them is a question, as it was interrupted in a more or less violent manner. A resident of Washington told me that once when visiting the shore he was advised by the fisherman with him to avoid the pools, and when it became necessary to cross them to pass over as quickly as possible, as large octopi frequented them. He considered this the exaggeration of a fisherman, and paid but little attention to it; but once in crossing a pool, stepping from stone to stone, suddenly a long livid arm shot out of the water and reached insinuatingly for his legs, the entire animal moving rapidly toward him. He, however, reached the rocks safely and bombarded the animal with stones. He estimated its size at twenty-five feet across, judging the tentacles to have been twelve feet in length. Again, it cannot be determined from this whether the animal would have seized him; though the observer was confident that it would, and that it was large enough to have held him under water had he been pulled in.

The specimen shown in the accompanying illustration was taken near Avalon, Santa Catalina Island. Its arms were over 10 feet in length, giving the animal a radial spread of at least 20 feet. The strength of these large octopi was shown in this instance, it being almost impossible to hold the animal until a large rope had been thrown about it. In Alaska the octopus attains even a larger size, individuals having been reported with a spread from tip to tip of tentacles of 25 or 30 feet. Such an animal is represented in the Yale Museum by a cast, and gives an excellent idea of how the living animal looks. At Santa Catalina Island small specimens are very common, and one has been taken in deep water—500 or 600 feet—having a radial spread of 15 feet, an uncanny monster, which, when it came up, threw its arms over the side of the boat and made a powerful resistance. Indeed, it was almost impossible to bring it in without tearing and cutting the large sucker-lined arms.

The octopus is a most interesting creature; its eight sucker-lined arms, like snakes, that creep into every nook, corner, and crevice; its power of changing color, blushing and paling at the slightest alarm, being features that appeal to the fancy and imagination. The octopus has a small mouth with jaws which call to mind those of a parrot and powerful enough to enable them to sever the vertebræ of good-sized fishes which they may capture. Each sucker is a factor, and when it is remembered that there are scores of them, with sharp cutting edges, one can imagine the reserve force and power of the animal. When closely pressed, they resort to the ink-bag and force a stream of ink out which permeates the water and in the shadow of which they escape. I have seen a squid hurl its ink a foot or more into the face of a boatman in Florida, who was peering into the water in search of them.

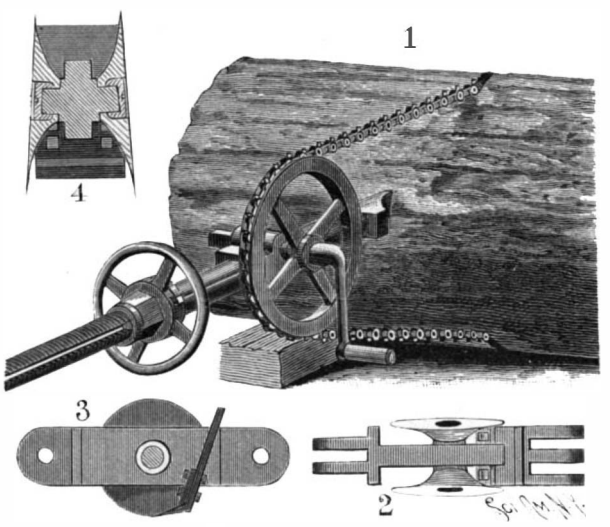
The octopi in confinement, previously referred to, eat fish or crab meat, and upon securing it, spread out their webs, covering as much surface as possible, and when eating, the tentacles are nearly always in motion, "wriggling" being the only term to describe their peculiar motion.



OCTOPUS TAKEN NEAR AVALON, SANTA CATALINA ISLAND, CALIFORNIA.

A MECHANICALLY-OPERATED CROSS-CUT SAW.

A novel cross-cut band or chain saw which is designed to saw logs far more rapidly and effectively than an ordinary saw has been patented by Matthew



CLARK'S CHAIN CROSS-CUT SAW.

J. Clark, of Chaparal, Arizona Territory. Of the accompanying illustrations, Fig. 1 is a perspective view of the saw in operation; Fig. 2 is a plan view of a link of the saw; and Fig. 3 is a side elevation of a link, with the one cutter removed. Fig. 4 is a section of a link. The apparatus comprises a bar having at one end a head adapted to engage the log. At the other end the bar is threaded and formed with longitudinal grooves. A box is mounted to slide upon the plain portion of the bar and has arms with opposite flanges extending within the grooves. A two-part nut, operated by a handwheel, is mounted to turn on the threaded end of the bar, between the flanges of the arms. In the box a shaft is journaled carrying a sprocket-wheel around which passes the chain-saw. The links of the chain, as shown in Figs. 2, 3 and 4, are provided at each side with cutting-wheels inclined to each other so that only the edges will engage the wood, thus preventing the clogging of the wheels by the kerf. Chisels are connected with the links and extend between the inner faces of the wheels. The chisels are designed to detach a layer of wood cut by the wheels. In operation, the head of the bar is driven into the log, the chainsaw is passed around the log and sprocket, and the box carrying the sprocket is shifted along the bar by turning the

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nut until the chain is taut. As the sawing progresses, the handwheel is turned so as to screw the nut outwardly in order to force the sprocket-wheel toward the outer end of the bar. When the nut reaches the end of the threaded portion of the bar, a segment of the chain is removed; and the nut is returned to its initial position.

IMPROVEMENTS IN ROTARY ENGINES.

The many failures which have attended the efforts to produce a successful rotary engine and the fact that the direct acting crank and rod reciprocating engine remains in full possession of the field have led many people into the erroneous belief that there is something inherently wrong in the principle of the rotary engine—that, like perpetual motion or the supposed self-multiplying powers of liquid air, its theory is based upon a misconception or absolute ignorance of natural physical laws. As a matter of fact, however, the objects aimed at in the rotary engine are perfectly legitimate, and the principles upon which inventors have been working ever since Ramelli, in 1588, designed his rotary pump, of which the rotary engine is actually a reversal, are perfectly sound.

The stumbling blocks which have brought rotary engine builders to grief have been entirely of a mechanical or structural nature.

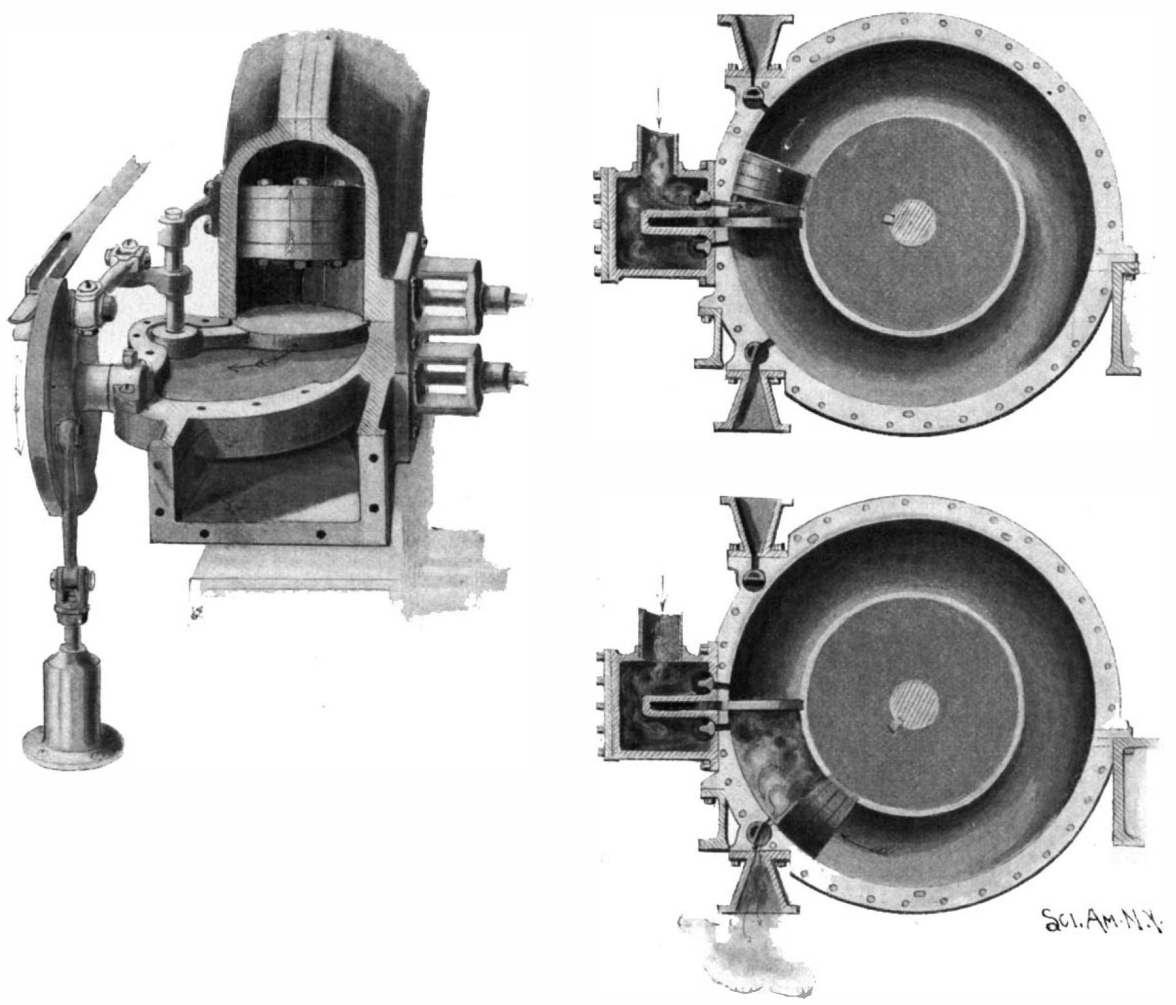
Undoubtedly the feature that has proved most attractive in the rotary engine is the fact that the pressure on the piston is at all points of the stroke applied tangentially to the circle described by the crank, and so avoids the "dead centers" of the reciprocating engine. The turning moment of any given amount of pressure at the crank pin upon the crank shaft is the product of this pressure by the vertical distance between the direction in which it is exerted and the axis of the crank shaft. In a reciprocating engine this vertical distance varies from zero on the dead centers to a maximum just before the half stroke, when the crank and connecting rod are at right angles. Consequently, a constant and even turning moment can only be secured in the reciprocating engine by connecting two cylinders to a common shaft and placing the cranks at ninety degrees. The piston pressure of a rotary engine, on the contrary, is always exerted tangentially to the circle described by the crank, and, consequently, its turning moment is at a maximum throughout the whole revolution.

There is, moreover, a loss of power in the reciprocating engine due to the change of direction of pressure at the cross-head, a certain component of the piston pressure being exerted against the guide bars. This loss is greatest when the crank is near the half stroke and the turning moment is largest. Another alluring feature of the rotary engine is the fact that the heavier reciprocating parts of the standard type of engine are dispensed with, and it is not necessary to provide the customary massive flywheel or heavy counterbalance weights. Lastly, there is the attractive feature of the economy of space that is realized by doing away with piston rods, cross-heads, guides, and connecting rods, and the economy in material and labor which is consequently realized in manufacture.

Now, the above well-known theoretical and practical advantages of the rotary engine cannot be disputed and they have served to attract an amount of mechanical thought and skill which has resulted in some extremely ingenious designs by such men as Cochrane, Napier, Fletcher and later inventors. While it is true that hitherto no rotary steam engine, except those of the turbine type, has been so successful as to establish itself in competition with the standard reciprocating engine, the rotary principle has been applied with marked success to various types of blowers, ventilators and pumps of which Roots' blower is the most notable example.

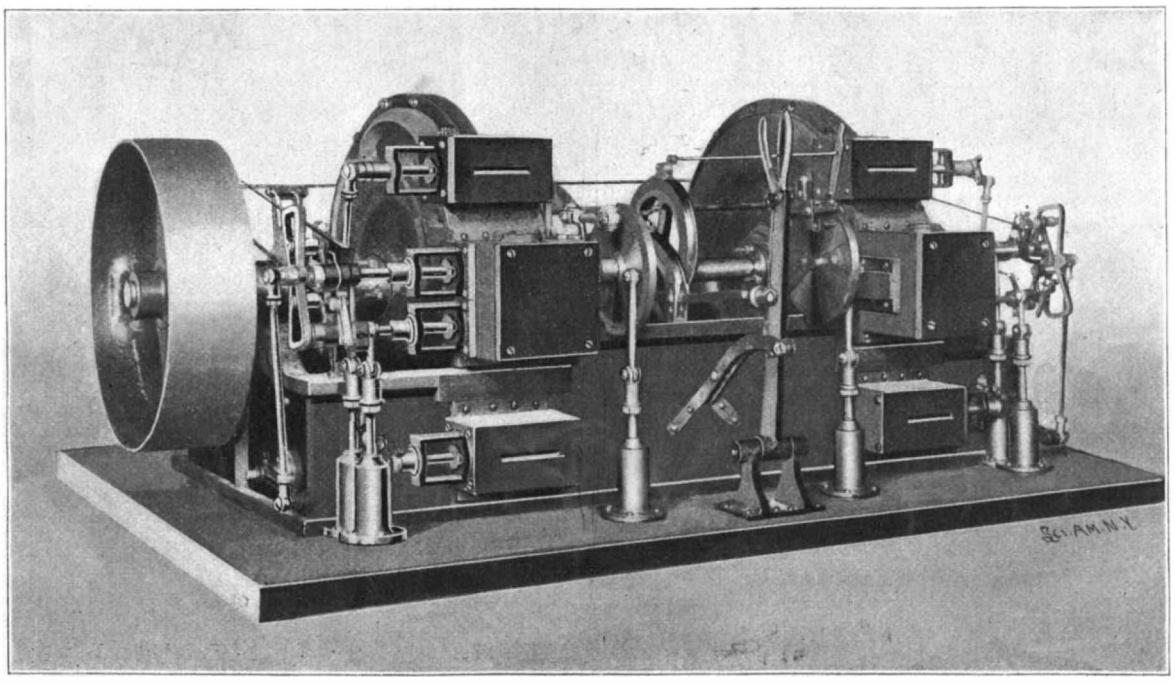
Chief among the difficulties which have hitherto stood in the way of the production of the successful rotary engine have been those of providing a satisfactory form of valve gear, steam ports, etc., for the admission and control of the steam and a suitable sliding abutment to support the reaction of the steam within the cylinder. The accompanying engravings of a two-cylinder rotary engine, which have been prepared from drawings furnished by Mr. T. M. Colwell, 704 Atwood Building, Chicago, Illinois, show an intelligent attempt on the part of the designer to overcome these difficulties, and it will be noticed that both in the details and general plan of the engine, there is a departure from previous types. In the first place the engine is in duplicate and consists of two annular cylinders, mounted upon a common shaft, each cylinder having its own independent valves and abutment gear, the only parts common to the two being the eccentrics, link motion and reversing mechanism. The annular cylinders are true circles in cross section, the pistons being segments of a true circular ring, with the faces radial to the center of the main shaft. They are packed with split piston rings, and it is stated that no difficulty has been experienced in securing steam-tight joints either in these or other moving parts of the engine. The adoption of the annular form of cylinder conduces to cheapness and accuracy of manufacture, and indeed in these respects it is perhaps the best form into which the rotary engine can be cast.

The vital feature of the engine is the abutment mechanism, shown in the accompanying detail drawings. A rotary engine to be efficient must be so constructed that the piston shall be under pressure substantially throughout its entire stroke, and it must be capable of expanding the steam to the extent that is attained in engines of the reciprocating type. To secure these results the steam must be admitted with a minimum amount of clearance between an abutment and a movable piston, and the supply must be capable of being cut off at any desired point of the revolution. Also it is evident that for the best results the arc of the circle through which the steam pressure is operative on the piston must be the greatest possible. This requires that the abutment be allowed to remain in place until the piston is about to complete the entire circle of movement, then very rapidly withdrawn to let the piston pass, and as rapidly re-inserted behind the piston so that the steam may be again admitted before the piston has had time to travel any appreciable distance without pressure.



ABUTMENT AND VALVE GEAR—COLWELL ROTARY ENGINE.

Now, the difficulty has been to remove and insert the abutment with sufficient rapidity without destructive hammering or bruising of the mechanism. In some engines the abutment has been moved slowly, with a consequent increase in what might be called the "dead" space in the cylinder, and to compensate for this the circle of the piston space has been inconveniently enlarged. In the present case the dilemma has been avoided by reducing the weight of the abutment, to allow the use of a "swinging" mechanism that is exceedingly rapid in its movement. Intimately associated with the problem of the swinging abutment is that of the position and action of the steam ports, and the whole problem is met by using the regular Corliss valves and gear and placing the admission ports in close proximity to the abutment. There are separate valves for the admission and exhaust, and these are provided in duplicate (as shown in the illustration), so that by throwing over a single reversing lever both engines may be reversed. This is rendered possible by using double links for working the valve stems, so that one pair of eccentrics does duty for the whole eight valves. The arrangement is clearly shown in the general view of the engine, where the lower and upper steam chests contain the forward and reverse exhaust valves, while the forward and reverse admission valves and the recess which receives the abutment during its withdrawal are contained in the larger central steam chest. The operation of the valves and abutment is shown clearly in the detail views. In the upper view the piston has swept by the abutment which has just been swung back into place, and the inlet valve is admitting steam, the exhaust valve being at the same time open. In the lower view the steam has been cut off and the piston is about to sweep by the exhaust port. The abutment will be withdrawn only just in time to clear the front face of the piston as it passes forward in its path. When the engine is reversed, the lower admission valve and the upper exhaust valve are utilized. The right hand drawing shows the mechanism for swinging the abutment, which is made exceptionally light and is pivoted on a vertical shaft which is at-



THE COLWELL DOUBLE-CYLINDER ROTARY ENGINE.

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tached by a rocker arm and connecting rod to an oscillating disk, as shown. The disk is oscillated by a horizontal shaft which is attached to a rocker arm actuated by the valve gear link motion. As this arm reciprocates it engages a pin on the disk and draws it forward, thereby swiftly removing the abutment from the steam space. The instant the abutment is clear of the cylinder, the horizontal arm is tripped and the disk under the influence of the dash-pot, which is shown below the disk, flies back to its normal position and swings the abutment into place within the cylinder. The arrangement and action of the valves and abutment indicate a careful study of the idiosyncrasies of the rotary engine, and in the matter of clearances at the abutment the design appears to be well up to the limit of possibilities of an engine of this particular type.

Repairing Vessels at Cavité.

Naval Constructor Hobson has some pertinent comment to make on the question of dry-docking facilities required by the government at Cavité, which he embodies in a report submitted to the Navy Department recently, on the question of the wrecked vessels raised in Manila Bay, which are now being repaired at Hong-Kong under his direction. Mr. Hobson contends that economy demands that the United States establish its own dock and repair station, and shows that large sums would be saved which are now paid private firms at Hong-Kong for overhauling American warships.

His report is an argument in favor of the maintenance in the Philippines of an important navy yard and dry dock, where the largest and most powerful vessels of war may be overhauled and attended to. The report states that in compliance with the bureau's direction the three vessels under reconstruction, the "Isla de Cuba," "Isla de Luzon," and "Don Juan de Austrias," are about 80 per cent completed. The value of the vessels when completed, exclusive of armament, will be about as follows: "Isla de Cuba," $215,000; "Isla de Luzon," $215,000; "Don Juan de Austrias," $180,000. Total, $610,000. Raising and refitting have cost about $304,000, making a net gain to the government on the three vessels of $306,000. The credit for this result is given to Naval Constructor Capps, who made the contracts. Thus the large engine parts were scarcely injured at all. This feature has an important bearing upon the wrecks still in Manila Bay which he is to examine with divers when the vessels now in hand are completed. The longer period that they have been immersed may not have seriously injured the principal parts, and there may be similar advantage to the government in further salvage, particularly as to the "Don Antonio de Ulloa" and the "Velasco," sister ships to the "Don Juan de Austrias," which, from all accounts, suffered less damage than those that have been raised.

Mr. Hobson adds: "There would be great advantage to the government in the establishment in the Philippines of a yard thoroughly equipped with docks and plant capable of doing all the work of docking and repairing of the navy. The British government is undertaking such an establishment here, though at great cost, involving the making and reclaiming of a large part of the land required. This would necessitate the employment of Chinese labor. This labor is not only unlimited, but it is equal to practically all the requirements of modern industry. Chinese do all the work inside and out for all the departments of the shipyard, white supervision being required only to show what is wanted. The Chinese have a remarkable natural aptitude. Their industrial capacity is simply marvelous. To the extent of my observations and inquiries, there is no place in modern industry which they cannot fill."

In his speech introducing the naval works bill in the Commons, Mr. Austin Chamberlain, in order to show the necessity for increased dock accommodation, stated that whereas, in the year ending March 31, 1889, the tonnage of the vessels built and building for the royal navy was 864,000 tons, on March 31 of this year it was 1,800,000 tons; more than double that of ten years ago. The longest battleship then was 345 feet long and the largest cruiser 400 feet. Now battleships of 400 feet in length are being built, and there are cruisers 500 feet long in commission.

The British government have in contemplation the immediate construction of five first-class docks for naval purposes solely. One of these new docks will be built at Chatham, and will be of sufficient dimensions to accommodate the largest ship afloat in the British navy. Another dock is to be built at Hong-Kong. This last named dock will be 750 feet in length and of dimensions to accommodate the ships of the "Majestic" class. At Bermuda another fine dock will be added to the one already at that important point. At Malta two docks will be laid down, and the latest improvements will be embodied in these docks, as also in the two to be built at Cape Town, Africa. These five docks are to be of stone and built in the most thorough manner and will cost an aggregate of $5,000,000.—Army and Navy Journal.

Correspondence.

Can Insects Count?

To the Editor of the SCIENTIFIC AMERICAN:

That insects have some idea of numbers is claimed by Lieut.-Colonel Delauney in La Nature, Paris, July, on the base of a single observation made upon what seems to have been a small bug allied to Corisa, in New Caledonia. It was noted that this species was gyrating upon a leaf, first in one direction, then in the other, beginning with six turns and coming down in order to one. This was done once only, and no other specimens were observed. That the insect could count from six to one is thus considered proved upon what seems to one who has observed insects remarkably slim evidence.

The gyrating habit is a common one in insects and especially among some of the smaller moths or Tineids, who rarely come to rest after alighting without first turning several times in one or both directions in succession. Sometimes, without apparent cause, they will begin a dance that lasts for some time, almost exactly as described by Colonel Delauney, save that I have never noted the regular decrease in the number of turns. I cannot in the least believe that the insects have any real idea of number connected with these turnings; but I am nevertheless convinced that some insects do count up to considerably more than six.

An interesting illustration came under my notice in July, while collecting on the New Jersey side of the Delaware, at the Water Gap. At the foot of the cliff, along the line of the railroad, all the old sumach canes were used by the little wasp Odynerus ornatus for breeding purposes, and from three to six brood chambers were found in the canes. The cells were stored with the larvæ of the locust leaf beetle, Odontata suturalis, then about full grown, and as a matter of curiosity I counted those in the cells of one stalk, finding ten in each store. To ascertain whether this was uniform I cut all that I could find at that spot and invariably ten larvæ were contained in a completed cell. The little wasp begins by putting in one larva and then lays an egg upon or at the side of it. Nine additional larvæ are then brought in, one at a time for the larva is almost as large as the wasp, and then the cell is capped. Now this insect can not only count up to ten, but it can carry the idea of numbers for some appreciable time. After three or four larvæ have been placed in the cell the bottom one is lost to view and counting from above becomes an impossibility. The insect must, therefore, keep tab on its trips so as to neither over nor understock its cell. It is not a question of length of cell and simply filling a given space, for the diameter of the stalks varied, and as the diameter became greater the length of the cells became less.

It is worth noting that the habits of this little wasp have not been recorded, heretofore; but I have no doubt its allies with similar habits will be found to have the number sense equally well developed.

JOHN B. SMITH, Sc.D.

Rutgers College, New Brunswick, N. J.,
August 25, 1899.

Wood Seasoning by Electricity.

In a recent issue of a European trade journal, there is a description of a new process of seasoning wood and timber by electricity, known as the Nodon-Bretoneau process, which must be a commercial success, for it is claimed that the company's shares are now at a premium of nearly 600 per cent, says E. Theophilus Liefeld, United States consul at Freiburg. The effect of the electrical treatment seems to be to expel the sap and replace it by insoluble matter which will not putrefy, and to increase the tenacity of the wood and its resistance to vertical compression.

This is said to be the first industrial application of the principle of electric osmose, viz., if the electrodes in an electrolytic solution are separated by a porous partition and a current passes, the volume of the liquid in contact with the positive pole diminishes, while that in contact with the negative pole increases.

The process is about as follows:

The positive pole of a dynamo is connected with a lead grating, upon which the wood to be treated is placed. A solution, which is kept at the uniform temperature of 100° F. by means of a steam pipe underneath the grating, is poured into the vat so as to almost cover the log of wood treated. At a public demonstration, the solution used contained 10 per cent of borax, 5 per cent of resin, and three-fourths of 1 per cent of carbonate of soda, the borax being used on account of its antiseptic properties and the carbonate of soda to help dissolve the resin. A porous tray, the bottom of which consists of two sheets of canvas with a sheet of felt between, is placed over the log, and a sheet of lead connected with the negative pole of the dynamo is placed above this.

When the current is turned on, the solution is drawn from the bottom and the sap driven out, and its place taken by the borax and resin. The time required for a 10-inch log is about seven or eight hours, and then the wood is slowly dried, which takes in the open air in summer several weeks or even months. It was stated that a unit of electrical energy was required for every six cubic feet of timber treated.

Commercial Education in Russia.

Commercial education is continually receiving more attention and encouragement in Russia. Not only the government, but also commercial institutions, large firms, and even private individuals, are opening new commercial educational establishments, varying from the engineering college (polytechnic) opened by the government at Warsaw last year, where young men who wish to become civil, mechanical, chemical, or electrical engineers, architects, or surveyors, can obtain a thorough theoretical and practical technical education, to the simple evening artisans' class, designed to give apprentices a certain amount of theoretical knowledge of their trade to supplement the practical knowledge gained at their work. Consul-General Murray says that between these two extremes come commercial schools, where boys can get a thorough commercial education as clerks or commercial men, and artisan schools, where the sons of workingmen can get a preliminary education at certain trades, such as carpentering, locksmiths, etc. It thus only remains for the parents, and the boy himself, to decide what line he will take, and how much time can be given to his education, for which facilities are at hand from the time he first goes to school until he has finished at the engineering college at 22 or 23. The two branches of commercial education which appear to be the most neglected, as compared with Germany, are shorthand, it being extremely difficult to get a clerk who can take down a letter in shorthand, and then print it off on the typewriter, so common an accomplishment elsewhere, and the careful special training of commercial travelers, which is carried to such a pitch of perfection in Germany, has little attention paid to it in Russia.—Journal of the Society of Arts.

Igniting a Jet of Hydrogen.

C. G. Hopkins describes a method by which a jet of recently generated hydrogen can be ignited with absolute safety and without loss of time. As soon as the action begins, collect the escaping gas in a test-tube, and, when the latter is thought to be full of pure gas, remove it two or three feet from the generator and ignite the hydrogen in it; then immediately attempt to light the jet of hydrogen with the hydrogen flame contained in the test-tube. If the gas is explosive, it will explode in the test-tube and leave no flame. If, on the other hand, a flame remains in the test-tube with which the jet can be ignited, it is certain that the gas in the generator is no longer explosive. By adopting the precaution, therefore, of never lighting the hydrogen jet except with the hydrogen flame obtained as described above, absolute safety can be insured. Attempts may be made to ignite the jet by this method as often as thought proper, and if the hydrogen is properly generated, the gas will be ignited in less than a minute.—Journ. Am. Chem. Society.

Extinguishment of Fires in Mines.

An account of the application of liquefied carbonic acid gas to extinguish underground fires was given by Mr. George Spencer at the recent meeting of the Institution of Mining Engineers, says Nature. At a colliery with which Mr. Spencer was connected a fire occurred in a heading, as the result of a fall of roof and sides on steam-pipes. The heading was built off with as little delay as possible, but notwithstanding all efforts to shut out the air, sufficient reached the seat of fire to keep it burning slowly. It was therefore decided to apply carbon dioxide, and for this purpose six cylinders of liquefied gas were successfully used. It is not claimed that the method described can be successfully applied to all fires, but there are undoubtedly many cases which might be so treated. In case of fire on shipboard, the use of carbon dioxide would no doubt prove invaluable, as it could be quickly applied, and would not cause the same damage to cargoes as water.

"City of Rome" Strikes an Iceberg.

The recent collision of the "City of Rome" with an iceberg brings forcibly to mind one of the many dangers to which transatlantic navigation is exposed. The vessel at the time was in latitude 48 30 N. and longitude 48·44 W. The weather was foggy and a rain had just ceased falling when an iceberg was sighted near at hand, and the ship was slowed down to quarter speed. Shortly after this a massive berg loomed up over the bow of the liner, and before the engines could be reversed she struck, and her bow lifted several feet, the vessel finally sliding back into the water again.

Fortunately she sustained no damage beneath the waterline, the only marks of the encounter being her crushed figurehead and a bent bobstay.

THE United States torpedo boat "Talbot" is being fitted with machinery for the use of liquid fuel and the work is being done at the Norfolk navy yard.

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Science Notes.

A Labrador mail steamer reports that the Peary expedition steamer "Diana" has been met and hailed and that all on board are well. The "Diana" expected to reach Disco, Greenland, on July 29.

Major Ross, who was sent to Sierra Leone by the Liverpool School of Tropical Diseases to discover the malarial mosquito, has wired home that the malarial mosquito has been found and to send help to carry on further investigations.

Stonehenge, on Salisbury Plain, is for sale; 1,300 acres of surrounding land are offered for $625,000. It is to be hoped that the British government will see fit to purchase Stonehenge, which is one of the most remarkable archæological monuments in the world.

The use of homing pigeons by the United States navy has become quite important, and we have already illustrated the system employed. Birds are now being educated by means of Long Branch steamers, in order that they may be used when Admiral Dewey arrives.

The recent explorations which have been made at Carthage have resulted in very important finds. The sanctuary of Jupiter Ammon has been discovered, and the current SUPPLEMENT and the issue for next week will both contain illustrations descriptive of the discoveries made in the Punic Acropolis.

The French surgeon, Dr. Doyen, has exhibited to numerous doctors and students at the Kiel University cinematograph pictures showing various surgical operations. The doctor advocates the use of such pictures for the education of students, saying they are far more effective than the most elaborately written descriptions.

Dr. Sven Hedin has departed on a new expedition to Central Asia, and expects to be absent about two years and a half, chiefly in eastern Turkestan and northern Thibet. The Russian government will give his expedition free passage over lines of railway and will provide him with an escort of Cossacks whenever he may require them.

The mining exhibits at the Paris Exposition will be most interesting. There will be two realistic representations and demonstrations of the art of mining. A shaft 5 feet in diameter will serve regular mine workings, and all of the machinery will be of the regular type in actual use in mines. Visitors will also have the opportunity of visiting the catacombs under the city.

The International Commercial Congress to be convened at Philadelphia, October 10, 1899, during the International Export Exposition, will be the first of its kind in all commercial history. Its members will be made up of delegates from the Chambers of Commerce, Boards of Trade, etc., and will come from Latin America, Africa, Australia, India, China, Japan and other countries.

The Director of the Geological Survey has just issued a pamphlet entitled "Maps and Descriptions of Routes of Explorations in Alaska in 1898, with General Information concerning the Territory." There are ten maps which are admirably executed. The pamphlet contains special reports on various expeditions and general information concerning the Territory by geographical provinces and some very valuable tabulated information, including the gold production of Alaska. The various routes and means of transportation are clearly shown. The publication is intended for widespread distribution, and copies can be obtained by the aid of Congressmen.

In the United States the drug store seems to be the one place in which Americans get something for nothing; postage stamps at government rates and free directories are the universal rule. Some New York druggists have decided to institute a reform in the matter of the directory at least, and have placed the book in an open box so that it can be reached by the dropping of a penny in the slot. The entry of the coin releases the spring, the lid may then be lifted and the book consulted. Many city druggists do not go to the expense of purchasing a new directory every year, but with the aid of a device of this kind it is probable that new directories would be forthcoming every year, and the proceeds might be devoted to charity and the druggist relieved of the "free directory" nuisance.

J. A. Brashear has just completed one of the pair of large astronomical camera doublets for the observatory of the University of Heidelberg, Germany. They are next to the largest ever made. They are 16 inches clear aperture and 80 inches focal length. Two of these doublets, each consisting of four lenses, are to be made and are to be used almost exclusively for the photographic discovery of asteroids. The reasons for making two cameras and objectives is to serve as a check. The track of an asteroid on an 8×10 plate is only about one-twentieth of an inch long for a three hours' exposure. As the curves of the lenses have necessarily to be very deep, the casting of the great disks was found to be very troublesome. The fund for the equipment was given by Miss Catherine Bruce, of New York city.

Engineering Notes.

The "Oceanic" started from Liverpool on September 6, at 7 P. M., for her maiden voyage to New York. It is expected she will arrive at New York at 7 A. M., September 13.

Nicholas Riggenbach, the engineer for many of the funicular and rack and pinion railways of Switzerland, died recently. He directed the construction of the Righi Railway.

The Boston and Albany Railroad are now running trains into the new South Station at Boston. The trains of the Providence Division will run into the station.

The "Kaiser Wilhelm der Grosse" has lowered the time of ocean passage from Cherbourg to New York by two hours and fifty-three minutes. It covered a course over the northern route of 3,049 knots at an average speed of 22·08 knots.

The Baltimore and Ohio Railroad has appointed an "Industrial Agent" whose duties are to advise manufacturers and others as to desirable locations for business enterprises. It is believed that this system will tend to develop the resources of the territory contiguous to the lines of the company.

A Providence company has recently made an emery wheel 39 inches in diameter and 12 inches thick. It was built up on a special iron center 31 inches in diameter, which ran on a $3\frac{5}{8}$ inch shaft. According to The Iron Age, the whole affair weighed over 1,200 pounds. The machine was designed for grinding wooden balls.

A commission appointed some time ago to consider the feasibility of construction of a mountain railroad to the top of Mont Blanc has made a favorable report, and it is possible that the enterprise will be carried out. If so, the line will start from Chamonix and extend almost to the apex of the great mountain, a length of 6¼ miles.

The Baldwin Locomotive Works have secured a contract to supply twenty compound locomotives for the Saxon State Railway of the German Empire. The price quoted is 54,760 marks each. One firm in Breslau made an offer of 220 marks lower, but they required much longer time to make the locomotives, so the contract was given to the Philadelphia concern.

The Chicago Drainage Canal is to be opened next December, and the trustees are now spurring on the contractors, and extra prices are to be paid to certain of them who will guarantee the completion of their work in December. It is desired to have the canal completed and opened before Congress meets, in order to avoid the opposition that will be made at the next session.

One of the most important American exhibitions at the Paris Exposition will be a model, some twenty feet long, of the Chicago Drainage Canal. In connection with this will be shown models of all the great variety of excavating and conveying machinery which was used in this important engineering work. The models will be shown in operation, and it is believed that it will be one of the most interesting of all the engineering exhibitions at the Exposition.

Following the wake of our Navy Department, the British Admiralty is about to add a modern steel floating dock to its docking equipment. The naval work bill, which recently passed its second and final reading in Parliament, contains an item for a first-class floating dock at Bermuda. Messrs. Clark & Standfield, designers of the naval 18,000-ton dock now being built at Sparrows Point, will draw the plans of this new dock of 17,500 tons lifting capacity. At present they are building in England, from their own designs, a steel floating dock for the Siberian Railroad, which will be sent out in sections to Yalienwan and there put together.

Nelson's old flag-ship, the "Foudroyant," was built in 1789 and was launched in 1798. She was wrecked at Blackpool in 1897, and part of her keel is now embedded in the sands at that place, and the remains of the vessel, her timbers, etc., are still in a yard at the place. At the Birmingham mint there are forty tons of copper from the vessel. Notwithstanding the fact that this ship, and the "Victory," were the only two remaining vessels which remind us of the famous sailors of the great fighting era, the Admiralty decided in 1892 to get rid of the relic, and she was sold to a German firm of ship breakers. Such an outcry was made that she was re-purchased, but in a curious hurricane on June 16, 1897, at Blackpool she broke from her moorings and driving shoreward became a total wreck. She was sold for $1,250, and the purchaser began the work of breaking her up. The first blast killed a woman who was passing on the beach, and this so disheartened the owner that he resold her to a syndicate. Some idea of the lively actions in the days of 80 gun ships may be seen from the data of powder and shot from the "Foudroyant" expended on the "Guillaume Tell." This was 162 barrels of powder, 1,200 thirty-two pound shot, 1,240 twenty-four pound shot, 100 eighteen pound shot and 200 twelve pound shot.

Electrical Notes.

The Odeon Theater, Buenos Ayres, is heated by electricity. This is not the first theater in the world to be so heated, but very few large public buildings have been warmed in this manner.

Electricity has been used to some extent for glass making. It is said that with the electric arc, a pot of glass can be melted in few minutes, which, in the old process, would require hours.

Herr A. Adt has found that magnets made from wolfram steel are more powerful than those made of other steel, but on the other hand, they lose their magnetism faster than some of the others.

Marconi's experiments have been so satisfactory to the British Admiralty that a complete set of apparatus for wireless telegraphy has been supplied to the "Defiance," the torpedo schoolship at Devonport, for future experiments by naval officers.

The Paris, Lyons and Mediterranean Railway Company has undertaken the construction and operation of an electric railway between Fayet and Chamonix. The power is to be furnished by the river Arve. Each car will be supplied with its own motor.

The New York, New Haven, and Hartford Railway are, it is said, contemplating the putting in of the third rail system electric line for passengers between the Harlem River and New Rochelle. Their other experiments in this line have proved very satisfactory.

The second section of the Jungfrau railway has been opened by the company. It is only half a mile long and consists of a tunnel with a continuous gradient of 25 per cent. After the line reaches the Eigerwand station, work will probably be stopped until more capital is subscribed.

The London County Council has authorized the expenditure of $50,000 for the construction of an experimental system of underground electrical traction. The underground trolley is used so successfully in the United States that it hardly seems necessary to spend $50,000 in demonstrating the value of a system which is already conclusively proved.

The manufacture of carbons for electric light is very interesting. The plastic mass is driven out through a small aperture with the aid of a hydraulic press. They are then baked in furnaces and are automatically electro-plated with copper. The plating operation is particularly interesting and is described and illustrated in the current issue of the SUPPLEMENT.

At the Paris Exposition the central power station will be 1,200 feet long and 120 feet wide. There will be 45,000 steam horse power and 25,000 electrical horse power. The steam will be supplied at a pressure of 142 pounds per square inch. Electricity will be supplied at voltages of 125, 250, and 500 for direct, and 2,200 for alternating currents. The price for steam power will vary from 1·68 cents per horse power to 0·57 cent per horse power, depending upon the size of the engine.

The third rail has claimed its first victim in Brooklyn, N. Y. A track inspector, while looking over the tracks of an elevated road, noticed that a screw in one of the rail clamps had worked loose. He was stooping to examine it, when he slipped on the ties and fell face downward on the electrically-charged third rail. In falling he thrust one of his feet backward and the lower part of his leg rested on the tin roof of the stairway leading to the street, thus establishing a complete circuit, and the full force of the current passed through his body. It was found that he had been horribly burned on his face, hands, and legs.

According to The Electrical World, Prof. W. L. Bryan, of the University of Indiana, and Mr. N. Harter, telegraph superintendent, have been investigating the mental processes in acquiring proficiency in the use of the Morse code. The investigators concluded, after a variety of tests, that the study of telegraphy is analogous to that of learning to read and of acquiring a foreign language. "There is the same rapid improvement at first, the same dispiriting level just below the ability to understand ordinary conversation, the same rapid ascent into usable knowledge of the language, and the same long struggle, seldom completed, before one has freedom in the language."

We have already referred to electrically propelled ferryboats, which are to be used between Philadelphia, Pa., and Camden, N. J. At first sight it seemed as though there was no necessity for having electric ferryboats, but it should be remembered that with the ferryboat the service is not continuous, and for this reason is not economical. The engines and boilers can only be used part of the time, but with an electrical equipment the charging of the storage batteries may be continuous while the boat is in the slip. A vast amount of space will be saved, and the storage batteries may be placed near the keel. The charging may be done while the boat is in its slip at the end of each trip. There will be no dust or odor, the attendance will be lessened, and there will be no time lost in making signals to the engineer, for there is no reason why the steersman cannot operate the motors from the pilot house.

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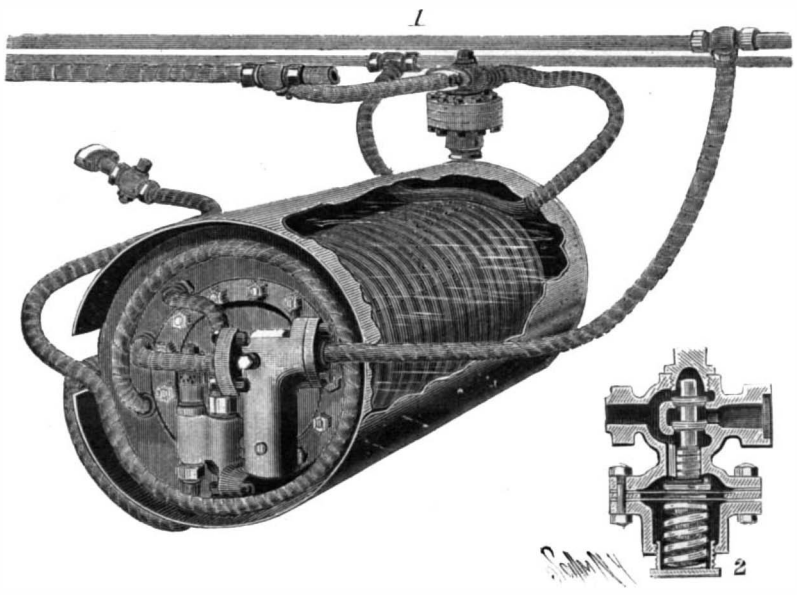
COMPRESSED AIR TRACTION IN NEW YORK CITY.

The extensive compressed air plant which has recently been erected by the American Air Power Company at the corner of Twelfth Avenue and Twenty-fourth Street, in this city, is now in active operation, and the new compressed air cars which it supplies are in regular service on the Twenty-eighth and Twenty-ninth Street lines of the Metropolitan Street Railway Company. The compressing engine is of special interest, both on account of its abnormal size and power and the high working pressure which is obtained. The single compressing engine is of 1,000 horse power, and the compressed air, after the fourth stage of cooling, is stored in the flasks at the high pressure of 2,400 pounds to the square inch. The engine, which is of the vertical cross-compound type, built by the Allis Company, of Milwaukee, is an extremely handsome specimen of the engine builders' art, and together with its massive brick foundations, it towers 60 feet above the ground floor of the building. Our front page engraving, which is taken at the level of upper floor of the engine house, shows only the engine proper and the upper courses of the massive brick piers on which it is carried. The diagram of the whole plant shows the compressors and the four inter-coolers situated on the ground floor of the building. The compressing engine has cylinders 32 inches and 68 inches in diameter by 60 inches stroke. Steam is furnished at a pressure of 150 pounds to the square inch, and working with the most economical point of cut-off the horse power is just 1,000. Our illustration shows the massive character of the construction, and as an instance of the size of its parts we may mention that the crank shaft is 22 inches in diameter, with bearings 20 inches in diameter by 36 inches in length, while the flywheel, which is placed centrally on the shaft between the cranks, is 22 feet in diameter and weighs 60 tons. The air compressor, which is carried directly beneath, is of the four-cylinder type, the compressing cylinders being securely anchored between the masses of brickwork which form the two legs of the piers. The low pressure cylinder is 46 inches, the intermediates are 24 inches and 14 inches, and the high pressure cylinder 6 inches in diameter, the common stroke, of course, being 60 inches or the same as that of the engine. The initial and first intermediate air cylinders are placed directly below the low pressure steam cylinder, and the second intermediate and high pressure air cylinders are below the high pressure steam cylinders. Each crosshead of the steam engine has four transverse arms, from which four distance rods lead down to connect with the corresponding crosshead to which the air pressure piston rod is attached. These rods are clearly shown on our first page engraving and in the diagram already referred to.

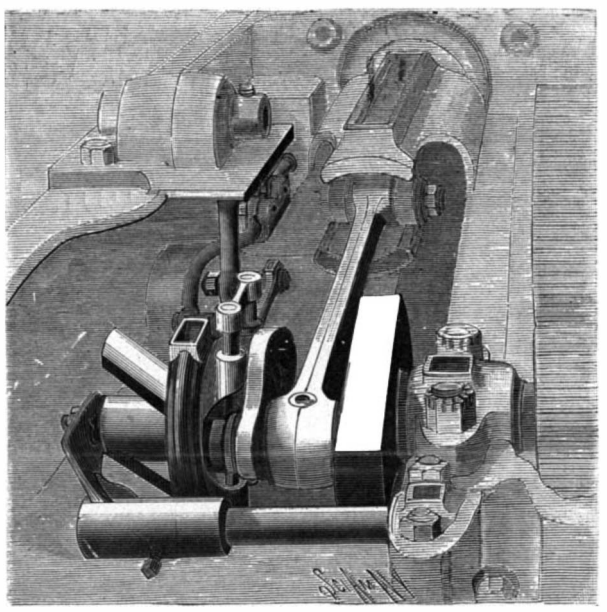


DETAILS OF THE HEATER AND REDUCING VALVE.

There are four sets of intermediate coolers for reducing the temperature of the air at each stage of compression, placed conveniently on either side of the foundations. Each of the two inter-coolers for the lower pressures consists of a cylindrical shell containing a set of vertical cooling pipes, while in the coolers for the higher pressures a single coil pipe is used; the air in each case passing through the pipes, which are surrounded with circulating water at atmospheric temperature. The action of the system is as follows: The air after compression in the low pressure cylinder is led through the first inter-cooler, from which it issues carrying a pressure of 40 pounds to the square inch. It then passes to the first intermediate cylinder, where, after further compression, it is led to the second inter-cooler which it leaves at a pressure of 180 pounds to the square inch. It is next compressed in the second intermediate cylinder, then cooled to atmospheric temperature at a pressure of 850 pounds, and finally it is compressed in the 6-inch cylinder and cooled to atmospheric temperature under a pressure of 2,400 pounds to the square inch, at which pressure it is led to a nest of storage cylinders in the charging room. The water used for cooling the air in the inter-coolers is taken from the North River, which is only a couple of hundred yards distant, through a 16-inch water main, and after passing through the inter-coolers the water is returned to the river through a discharge main of the same size. Adjoining the engine house is a charging plant and a car house. The cars on their return from a trip are run in on the tracks adjoining the storage cylinders, where suitable connections are made and a fresh supply of compressed air at the working pressure is fed to the storage cylinders, which are carried beneath the seats of the cars.

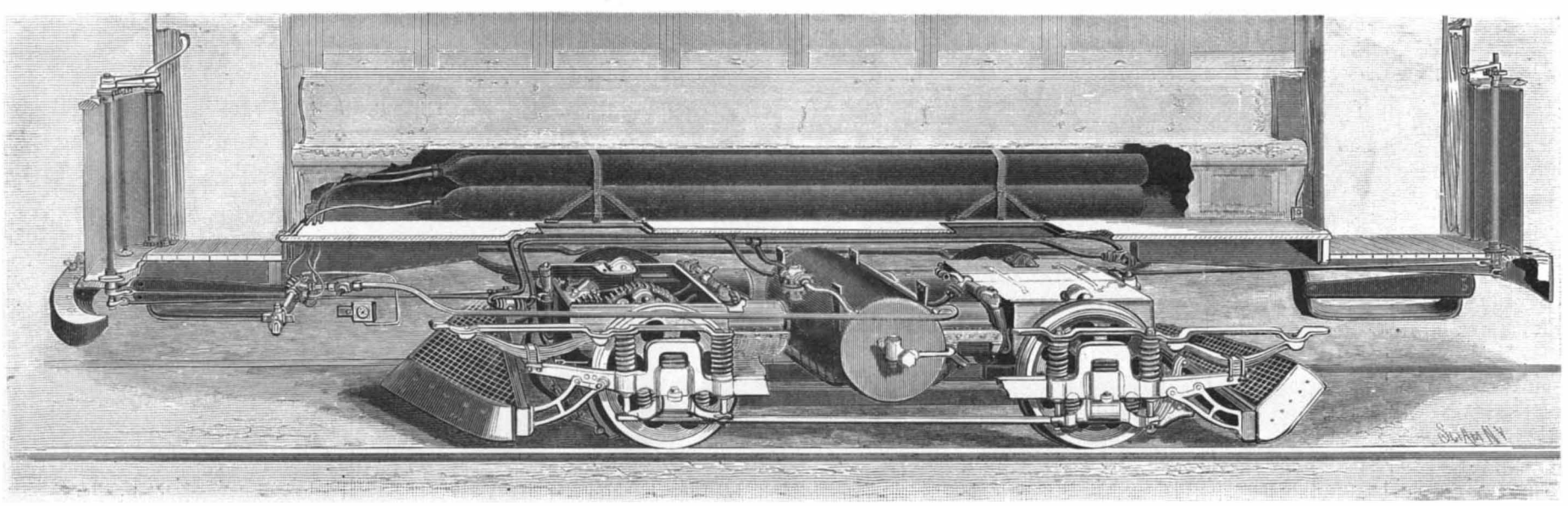
The cars which are being used in this service are practically the same in construction as the four-wheel cars which are used on the underground trolley lines. The car body weighs 6,000 pounds, the trucks 4,500 pounds, the air reservoirs 4,200 pounds, two motors weigh each 1,400 pounds, and the other parts and fittings of the car bring up the total weight to about 9½ tons. The air motors are carried one upon each axle, in two dustproof cast iron casings. Each axle is driven independently, one of them by the two high pressure motors and the other by the two low pressure motors. It will be thus seen that the cars are made to conform in respect of distribution of the driving power to the standard practice on electrically equipped lines. The high pressure motor has two high pressure cylinders, each 4 inches in diameter with a 6-inch stroke, and similarly the low pressure motor has two cylinders 8 inches in diameter by 6-inch stroke. In each case a 9¼-inch pinion is geared upon the crank shaft and meshes with a 21-inch gear wheel keyed on the middle of the car axle. The cylinders are bolted to the casing and lie outside of the same, while within the casing are the piston rods, crossheads, cranks, gears, and in fact all of the moving mechanism, and the whole is closed in with a cast iron cover, which on being lifted exposes all the moving parts for inspection or repairs. One of our engravings, showing one cylinder and its connections, is introduced to illustrate the construction of the reversing mechanism. The eccentric disk is not mounted directly upon the shaft but upon a pair of parallel guides which are pitched at an angle to the shaft, one above and one below it, and have a motion parallel to its axis. When the guides are thrust in toward the crank the eccentric disk is thrown up, and when they are drawn out the disk is thrown down, thereby giving a forward or reverse motion to the engine. The idea is not new; but it has been ingeniously applied in the present instance, and lends itself admirably to the peculiar construction of these motors. It does away with one eccentric and the usual link motion. The bottom of the casing is filled with oil so that the motors are self-lubricating after the fashion of the Westinghouse and other fast-running engines. The construction is very compact and the whole design well worked out.

The compressed air is carried in seamless steel flasks, which are placed beneath the seats of the car, three on each side, as shown in the accompanying engraving. The flasks are 21½ feet in length by 2 feet 5 inches in external circumference and they are tested, before being placed in service, to a pressure three times as great as the working pressure. From the ends of flasks the air is led through the heater, a wrought iron cylindrical reservoir which is supported between the two motors, as shown in the detail drawings of the car and the heater. The latter is charged with 60 cubic feet of hot water under a pressure of 210 pounds at a temperature of 400 degrees. After the pipe has passed through the heater where the air takes up sufficient heat to prevent the subsequent freezing of any moisture which it may contain, the air enters the reducing valve, of which we show a sectional view, where its pressure is lowered from 2,400 pounds to 320 pounds to the square inch. It then passes to the throttle valves at each end of the car, and thence to the injector, where a proper amount of moisture is sprayed into the air from the heater, the temperature of the spray being, of course, 400°. The air with the moisture which it has taken up now passes through a spiral coil in the heater (see detail view), where its temperature is raised to that of the heater, or 400°, at which temperature and corresponding pressure it enters the high pressure cylinders. From the high pressure cylinders it is carried direct to the low pressure cylinders and then exhausts to the atmosphere on the under side of these cylinders through a muffler. The exhaust, except at starting, is scarcely audible.



HALF VIEW OF ONE MOTOR, SHOWING REVERSING GEAR.

It will be seen that the system of the American Air Power Company differs very materially from that of the Hardie system, which we have already described at considerable length in this journal. (See SCIENTIFIC AMERICAN of January 30, 1897.) In the latter system the air is allowed to pass freely through the hot water of the heater, but this method has the serious defect



ARRANGEMENT OF STORAGE FLASKS, MOTORS, AND HEATER ON COMPRESSED AIR CARS OF METROPOLITAN STREET RAILWAY COMPANY.

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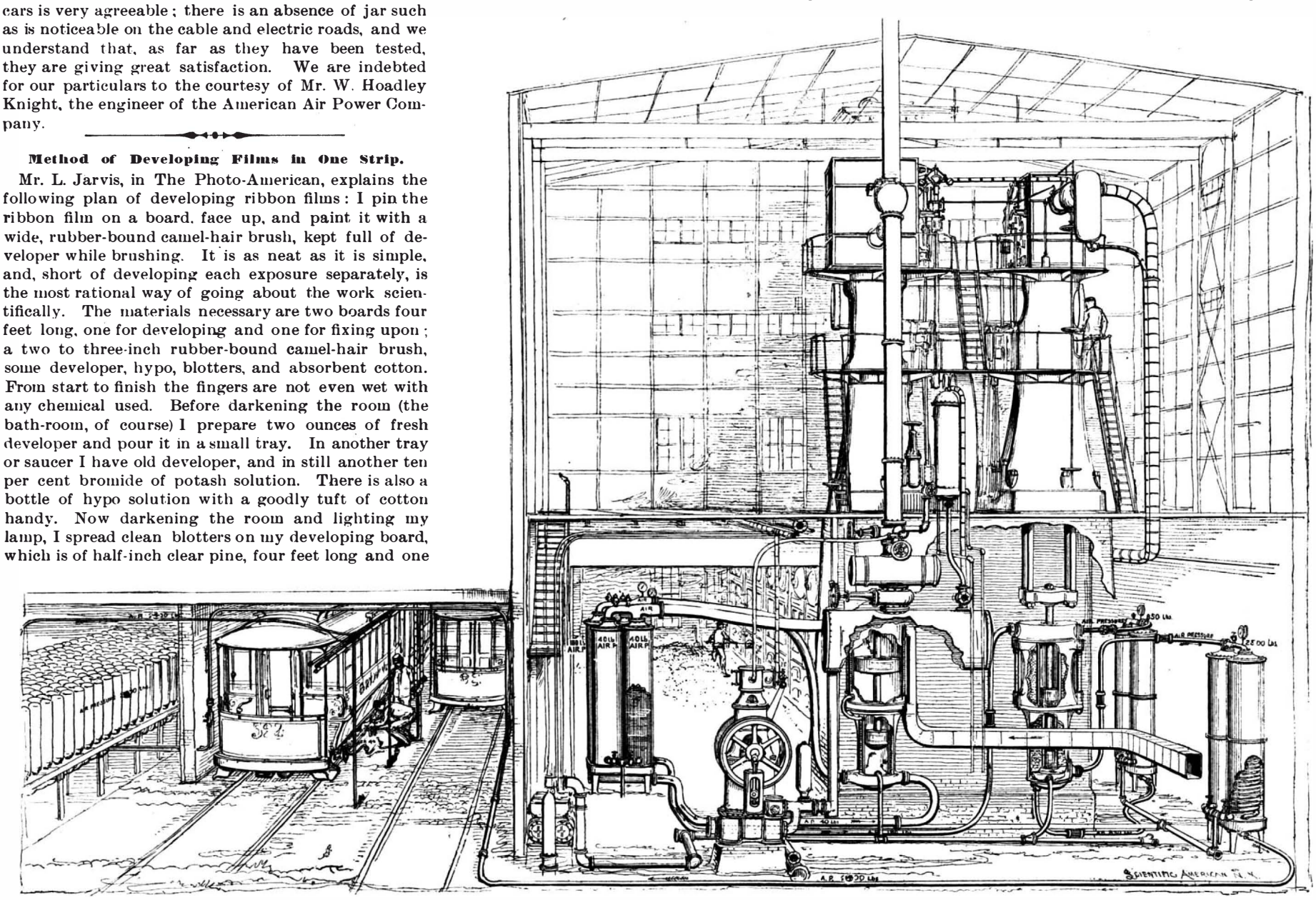
of being liable to carry excessive quantities of water into the motors, and of reducing the pressure in the heater from that of air to the pressure necessary to maintain the water at a temperature of 400°, and these drawbacks are avoided by the type of heater used on these cars. The moisture taken up by the air has the double advantage of giving a better packing at the joints and of serving to maintain the pressure throughout the full stroke of the pistons by continually vaporizing during the advance of the piston after the point of cut-off. The speed of the car is controlled partly by the variation of the cut-off and partly by the manipulation of the throttle, the control in both cases being operated from the platform, where there are two handles, the upper one working the throttle, the lower one the cut-off. The cut-off has four notches corresponding to three variations in the speed and the full stop.

Under the present conditions of working, the cars have a capacity of fifteen miles with a charge of air occupying all space intermediate the seats, or the capacity could be increased up to as high as forty miles by placing on the cars as large a number of flasks as could possibly be crowded in, or it could be increased by raising the working pressure, a change which the company is now about to make. The motion of the cars is very agreeable; there is an absence of jar such as is noticeable on the cable and electric roads, and we understand that, as far as they have been tested, they are giving great satisfaction. We are indebted for our particulars to the courtesy of Mr. W. Hoadley Knight, the engineer of the American Air Power Company.

Method of Developing Films in One Strip.

Mr. L. Jarvis, in The Photo-American, explains the following plan of developing ribbon films: I pin the ribbon film on a board, face up, and paint it with a wide, rubber-bound camel-hair brush, kept full of developer while brushing. It is as neat as it is simple, and, short of developing each exposure separately, is the most rational way of going about the work scientifically. The materials necessary are two boards four feet long, one for developing and one for fixing upon; a two to three-inch rubber-bound camel-hair brush, some developer, hypo, blotters, and absorbent cotton. From start to finish the fingers are not even wet with any chemical used. Before darkening the room (the bath-room, of course) I prepare two ounces of fresh developer and pour it in a small tray. In another tray or saucer I have old developer, and in still another ten per cent bromide of potash solution. There is also a bottle of hypo solution with a goodly tuft of cotton handy. Now darkening the room and lighting my lamp, I spread clean blotters on my developing board, which is of half-inch clear pine, four feet long and one foot wide, and, unrolling my film, pin it, face up, on to the board, two pins at each end, and two on the edge, about in the center, being plenty. I generally develop two or three rolls of folding pocket Kodak film at a time. Now filling my brush with water, I gently brush all the film over, enough to soften the emulsion, and then in the same manner paint the strips with fresh developer, keeping the brush moving slowly over the film, enough to insure its being moist with developer all the time. The over-exposed ones come up first, of course, and those are first swabbed over with bromide, and then kept wet with old developer and bromide alternately. I apply these with a tuft of absorbent cotton held on a stick with a rubber band, stick and cotton to be discarded each day. The other films, meanwhile, have been developing nicely, and can be so manipulated that they finish with the rest, adding little touches of bromide, old developer, or alkali, as needed, with a round brush. The under-exposed films are given all possible encouragement by treatment with developer suited to their wants, and by a hot blotter of the right width slipped under them. This is a very effective accelerator, and helps the film as no amount of developer would. I keep a few blotters wound around the hot water pipe in summer, or the steam pipe in winter, and thus have them right at hand. Those whose dark rooms have no such convenient arrangement can, doubtless, heat the blotters on top of the dark-room lamp. The films remain moist with developer nicely, and it is no trouble at all to keep them covered if well wet at first. I never had a case of spotting yet from unequal application of the developer by the brush, and I have developed a large number of rolls in this manner. In winter, if the film is brittle, a drop or two of glycerine in the developer will be found excellent. There need be no hurry, no worry about results, and an easier way of improving a negative by local treatment could not be imagined, as it all lies before the operator as plain as a picture, and the spots which need bringing out or retarding, as the case may be, show plainly. In developing a number of strips at once in a tray, one cannot stop long to doctor little patches, because the other films need constant turning; so all get the same treatment practically, and we all know what the average is by such a manifestly imperfect method. Having finished developing, remove the pins, and, with a bit of blotter grasped between thumb and finger of each hand, remove the film to the other board, which is not covered. Pin it down securely, using about eight pins, and put it in the bath tub under the tap to clear it of stain. After a few moments remove it to the table and mop it over gently with a large swab of cotton containing all the hypo it will hold. Continue to drag the swab of hypo over the film, taking fresh solution as necessary, until it is completely fixed, which can be ascertained by unpinning one end and examining the back. I purposely do less swabbing at one end, so that, when that end is found to be fixed, it can be depended upon that the whole roll is. This saves examining more than a couple of inches at the end.

When this part of the work is complete, I place the board in the bath tub, film down, and let it float upon the surface of the water, which is kept changing. If the weather be warm, the film can be painted with alum solution during any stage of the performance. It is well to do this after fixing always, even though not apparently necessary, as the film may soften in the wash water. Washing is very thoroughly accomplished in fifteen minutes. Everything upon the film which we wish to wash off, the hypo, to wit, is heavier than water, and consequently falls off better in the tub when on top of the water, than it would were the water on top of it. If the film was much under-exposed, and prolonged development has left it considerably stained, it should be painted with a weak solution of tartaric acid after washing a few minutes. A saltspoonful of the powdered acid to a cup of water, or, to be more exact, two grains to the ounce of water, will be strong enough to remove the greater part of the stain. All the stain should not be removed, especially from a thin negative, as the color in the film helps the printing in the shadows. After the acid treatment the full amount of washing should ensue, when nothing remains but to swab the film with glycerine solution, made of glycerine, quarter fluid ounce (a teaspoonful will answer); water, eight ounces, or one half-pint. After swabbing this solution over the negative two or three minutes, stand the board on end in a dry, but not too warm, room, until quite perfectly dried. Then throw away the mixed developer, swabs, also the blotters, if much soiled, wash the developing brush well, and all is through with. Each board must be marked, and always used for the same operation.



GENERAL PLAN OF 1,000 HORSE POWER COMPRESSORS AND CHARGING STATION.

A New Textile Plant.

Consul Atwell writes from Roubaix that some years ago an explorer in Asia discovered a plant of silken fiber, used by the Turkomans for the manufacture of withes and cord and by the Canagues for woven goods. This plant, known as the Apocynum venetum, is a sort of bush with slender cylindrical branches, sometimes six feet high. It grows in Europe, Siberia, Asia Minor, the north of India, Manchuria, and Japan; but it is not cultivated, and, up to the present, has been used only in the natural state. The branches die yearly, and in the spring new shoots start horizontally from the roots. It flourishes best where the land is under water during a part of the year, notably in the neighborhood of rivers that overflow at stated periods.

Under favorable conditions, the Apocynum develops quickly, and in a short time the branches form a thick growth, almost like a miniature wood. The best fiber is obtained by cutting the branches in midsummer, when the plant has obtained its full growth.

The attention of the Russian government was called to this plant in 1891. It is there known as the Apocynum sibericum, because it was first seen in Siberia.

It grows luxuriantly on the banks of the Amu Darya and the Ili, and the natives of these regions have used the fiber for many years for cord and fish nets. They value it not only for its great strength, but also because no care is required in its cultivation.

In 1895 the Russian government began to use it in the manufacture of bank notes, and since then the plant has been cultivated at Poltava. The results obtained thus far are considered excellent, and the time is doubtless near when the Apocynum venetum will take an important place in the textile market.

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FIN KEEL CENTERBOARD FOR ONE-RATER.

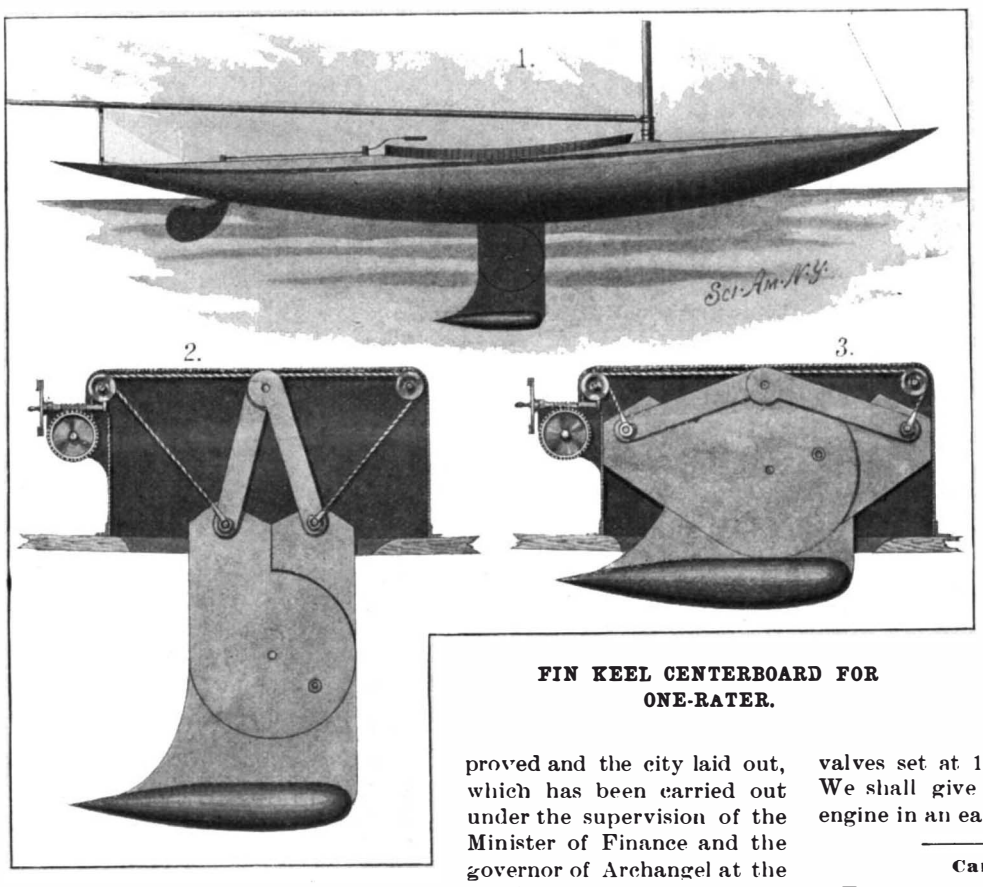
In the earlier days of international yacht races, the struggle was more distinctly one between types than it is to-day. The advocates of the wide, shallow hull, with its lifting centerboard, and the deep, narrow hull, with its fixed keel carrying a mass of lead on its lower end, were firm believers in the superior advantages of their favorite and widely divergent types. It was claimed for the American centerboard sloop that its wide beam, small displacement, big sail plan and narrow board dropped down to grip the deeper water and hold the craft up to the wind, was the ideal craft for speed and convenience. On the other hand, the advocates of the cutter type pointed with pride to the staunchness and weatherly qualities of the deep keel, outside ballast craft, with her snug sail plan, lofty and unobstructed cabin, and fine heavy weather qualities.

The centerboard craft always was and always will be popular on a coast like our own Atlantic coast, where many of the harbors are shallow, because of the ease with which the draught can be lightened by merely lifting the board, and the yacht be taken into an anchorage which would be inaccessible to the cutter with her deep, fixed keel. On the other hand, the enormous stiffening effect of that lump of lead, hung many feet below the waterline, was for years the object of covetous regard on the part of the centerboard skipper.

It was only a question of time when an attempt would be made to combine the sliding keel with the outside lead, and of late years, in the smaller boats, some very ingenious combinations for this purpose have been brought out. One of the difficulties attendant on weighting a centerboard of the ordinary triangular shape is the change in the trim of the boat which occurs when it is drawn up. To preserve the trim, the keel should lift vertically instead of swinging on a forward hinge.

We have been favored by Mr. H. W. Fairbrass, of London, with a drawing of an ingenious lifting bulb keel, in which a true vertical lift is accomplished by making the keel-plate in three jointed portions, the upper two of which work on a central pivot somewhat after the manner of a pair of scissors, the lower portion of the plate, carrying the bulb, being hung from the same pivot. Two jointed arms pivoted at their upper extremities at the top of the centerboard casing, and at their lower ends to the two upper sections of the keel-plate, together with a pair of hoisting ropes, complete the toggle joint arrangement by which the plate shuts up within the casing. The hoisting ropes are wound upon a drum outside the casing, which is operated by a worm and wheel.

In the drawings the keel is shown applied to a one-rater, and the dimensions, weight, etc., for a boat of this size are as follows: The casing measures 2½ feet in height, 4½ feet in length, and 1 inch in width. The width of the plates is 2½ feet and the total drop of the keel 4 feet and the exposed area is 10½ square feet. The lead bulb is 8 inches in depth by 4 feet in length and its weight about 800 pounds. The members of the keel plate, it should be noted, are held in a true longitudinal plane by means of a pin which is riveted firmly to the left-hand upper section of the keel and moves in radial slots cut in the right-hand and lower sections. The plates are recessed into each other as far as practicable so as to reduce the projecting edges and present as little resistance as possible to the water.



FIN KEEL CENTERBOARD FOR ONE-RATER.

A Record Year for Manufactures.

American manufacturers made their best export record in the fiscal year just ended. Not only were their exportations larger than in any preceding year, but for the second time in the history of our foreign commerce they exceeded the value of the imports of manufactures. In the fiscal year 1898, for the first time in the history of the manufacturing export trade, the exportation of manufactures exceeded the importation of manufactures, the total value of exports of manufactures being about 25 per cent in excess of that of imports of manufactures. In the fiscal year 1899, however, despite the increase in imports of manufactures, the total exportation of manufactures was 30 per cent greater than the importation of manufactures, being $338,667,794, against $259,570,293 of imports of manufactures.

Prior to the fiscal year 1898, imports of manufactures were always greater than exports of manufactures. From 1888 to 1897 imports of manufactures ranged about $1,000,000 a day, with the single exception of 1894. During all that time the exportation of manufactures was steadily increasing, so that in 1897 they amounted to $277,000,000, against $130,000,000 in 1888, having thus more than doubled in that period. In 1898 they were $290,697,354, and in the year just ended, as already indicated, $338,667,794. It was not until 1898 that through the combined reduction of imports and increase of exports the tide turned in favor of American manufacturers, and in that year the total exports of manufactures were, for the first time, greater than the imports of manufactures, being $280,697,354, against $230,897,676. In the fiscal year 1898, the exports of manufactures exceeded the imports by $59,799,678, and in 1899 the exports of manufactures exceeded imports of manufactures by $79,097,501.

A Russian Arctic Port.

A new port was opened July 5, 1899, near the Catherine Harbor, the extreme northern part of Russia's possessions. The city will be called "Alexandrovsk" in honor of the late Emperor. He sent his Minister of Finance to visit the northern coast in 1894. The Minister reported that the location of a city at a point where a good harbor could be found was necessary to the development of the Mourman region. Kola, the principal commercial town of that region, is on a narrow, shallow gulf, and is inaccessible to ordinary vessels, and thus forces the trade of the north of Russia to seek Norwegian ports. The Catherine Harbor was found to be located near the center of the marine industries of the Mourman coast, with ample depth to admit the largest steamers, and it is a curious fact that the Gulf Stream keeps it from freezing during the winter. In 1896 the Emperor ordered this harbor improved and the city laid out, which has been carried out under the supervision of the Minister of Finance and the governor of Archangel at the small cost of $250,000, inside of five years from the time that the improvement was first suggested. Work was begun only three years ago. Consul-General Holloway states that the new port of Alexandrovsk will soon become an important center for the industries of northern Russia, as it is capable of enormous development.

Dust from Africa in Europe.

At the suggestion of Prof. E. Ray Lankester, Lieut. A. G. Froud has sent us a copy of a report by G. T. Prior upon some fine brown dust collected on board the Peninsular and Oriental steamship "Sumatra" during a thunderstorm in the Galita Channel, in the Mediterranean. The dust contained about 33 per cent of doubly refractive grains, composed chiefly of carbonates of calcium, magnesium and iron. After treatment with hydrochloric acid, the insoluble residue was for the most part without influence on polarized light, and consisted mainly of silicate of alumina (clay), with a little organic matter; only a few angular grains of quartz and one or two very strongly refractive and doubly refractive grains, probably of iron, were observed in this insoluble residue. The dust was thus of the nature of an argillaceous and calcareous sand, and may have been carried by wind from the north of Africa. In his report, Mr. Prior remarks: "An account by C. V. John, with analysis, of fine brown dust which fell in Hungary in February, 1896, appeared in scientific publications at the time. This dust, like the above, was characterized by the almost total absence of quartz, and by the presence of grains of transparent amorphous clay material. It differed from the above, however, in not containing any large amount of carbonates. The similarity in chemical composition of this Hungarian dust with that of Nile mud is pointed out, and the suggestion is made that the dust may have been derived from Egypt."—Nature.

A New Development in Locomotive Boilers.

A large locomotive has recently been turned out at the West Albany shops for the New York Central Railroad, which embodies a novel and promising feature of boiler construction. It was built from the designs of Mr. Cornelius Vanderbilt, Jr., who has lately been giving considerable attention to the question of locomotive improvements. It is well understood that the standard type of firebox as now constructed is one of the most costly features in the boiler. On account of its rectangular shape and flat sides it has to be heavily stayed to the outer shell of the boiler and is one of the parts that call for most careful attention and most frequent repairs. In the new locomotive a tubular, corrugated furnace, 64 inches in diameter and 11 feet 2¼ inches in length, is placed eccentrically within the back of the boiler shell, which, in the neighborhood of the furnace, is 7 feet 1⅝ inches in diameter. The corrugated furnace is supported at its front ends by sling stays which are attached at the tube sheet. At the rear the large furnace tube extends about 6 inches beyond the back face of the boiler, to which it is flanged. A brick wall, 20 inches in height, extends above the grates at a point about 30 inches to the rear of the tube sheet, the space between the brick wall and the tube sheet forming a combustion chamber.

The furnace presents a heating surface of 191½ square feet, and in the 332 tubes there are 2,164½ square feet, the total heating surface therefore being no less than 2,356 square feet. There are 35·2 square feet of grate area. The total weight of the engine is 160,000 pounds, and a boiler pressure of 185 pounds to the square inch is carried.

As far as we know, the use of the corrugated tubular furnace in a locomotive of the standard type is entirely new in America; the only other instance of the use of the corrugated furnace being the Strong locomotive, which, among other peculiarities, carried a bifurcated boiler with two separate corrugated fire boxes. If the manifest advantages of this system of construction can be utilized in a locomotive of the standard type, Mr. Vanderbilt has set a very valuable precedent, which will probably be extensively followed in American locomotives.

The boiler has shown excellent steaming qualities and as compared with the standard engines of the road it marks, in this respect, a decided advance. Evidence of this was shown during a trial trip with sixty-seven empty cars, when the pressure ran up to 195 pounds in spite of the fact that the two pop valves set at 180 pounds were blowing off strongly. We shall give illustrations and fuller details of this engine in an early issue.

Car Couplings in England.

The committee appointed to examine designs for improved couplings for railway vehicles in Great Britain state that they are prepared to receive any photographs or written or printed description of automatic or non-automatic couplings for railway vehicles, but not with a view of making any selection from the various inventions which may be submitted. The committee are not at present prepared to receive models of any couplings, but if models or personal attendance is required, the persons interested will be notified. All such drawings and photographs or descriptions must be sent to the Secretary, 6 Old Palace Yard, London, S. W., England, on or before October, 1, 1899.

The committee does not give any assurance that communications made to them on the subject of the inventions will be protected, so that we recommend those of our readers who expect to submit their ideas to this committee to protect their inventions. The report of the committee will undoubtedly be of far reaching importance, and the question of automatic couplings is now agitating the British newspaper press as well as the technical press.

RAILWAY traveling in Algeria certainly leaves very much to be desired. From Algiers to Biskra is 400 miles, and it requires thirty-six hours to perform the journey. The trip from Oran to Algiers is 263 miles, and this requires twelve hours. Sleeping cars are required on all night trains and restaurant cars on all through trains.

WE regret to note that M. Gaston Tissandier, the French physicist and aeronaut, died on September 8 at Paris. He was for many years editor of La Nature.

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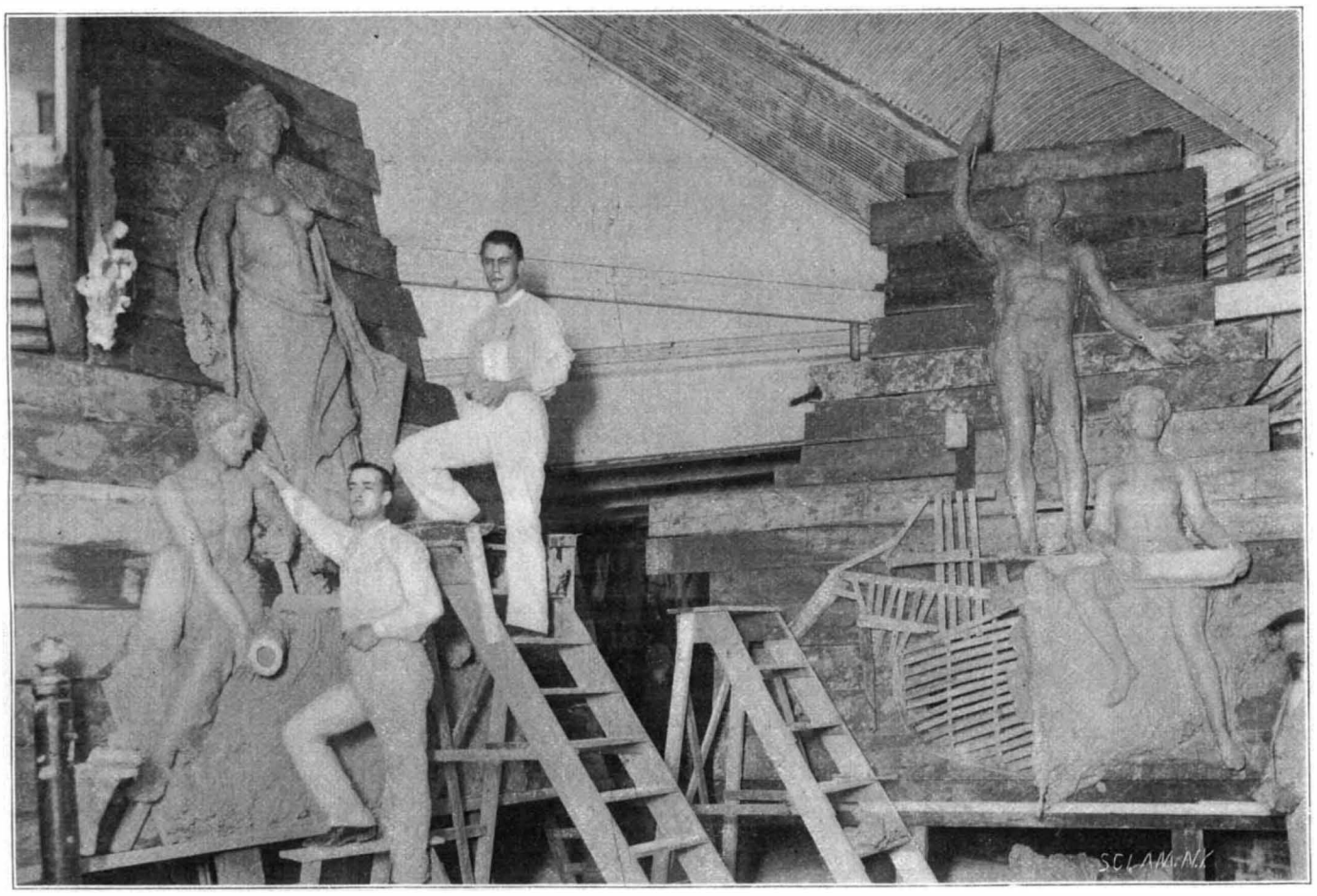
THE DEWEY ARCH.

The National Sculpture Society is always in the front rank when any public work connected with the beautifying of our cities is concerned. Naturally New York, being the home of the society, is the subject of its special care. When it was known that this city would be the scene of Admiral Dewey's home-coming, Mr. Charles Rollinson Lamb proposed to the president of the National Sculpture Society, Mr. J. Q. A. Ward, that the sculptor members be requested to make plans for the decoration with sculpture of a triumphal arch, which has been considered at all times the greatest tribute which can be made to a returning victor. The scheme was warmly indorsed by the sculptors, all volunteering to do their share of the work freely. A special committee was appointed to confer with the Dewey committee, and the scheme was received with enthusiasm. When the enormous quantity of sculpture is considered, it will be seen that these public-spirited men have really made contributions which, in a more durable material, would have been worth a million of dollars. Neither time nor money was available to make a permanent memorial, so a more evanescent material has been employed.



MODELING FIGURES FOR THE DEWEY ARCH.

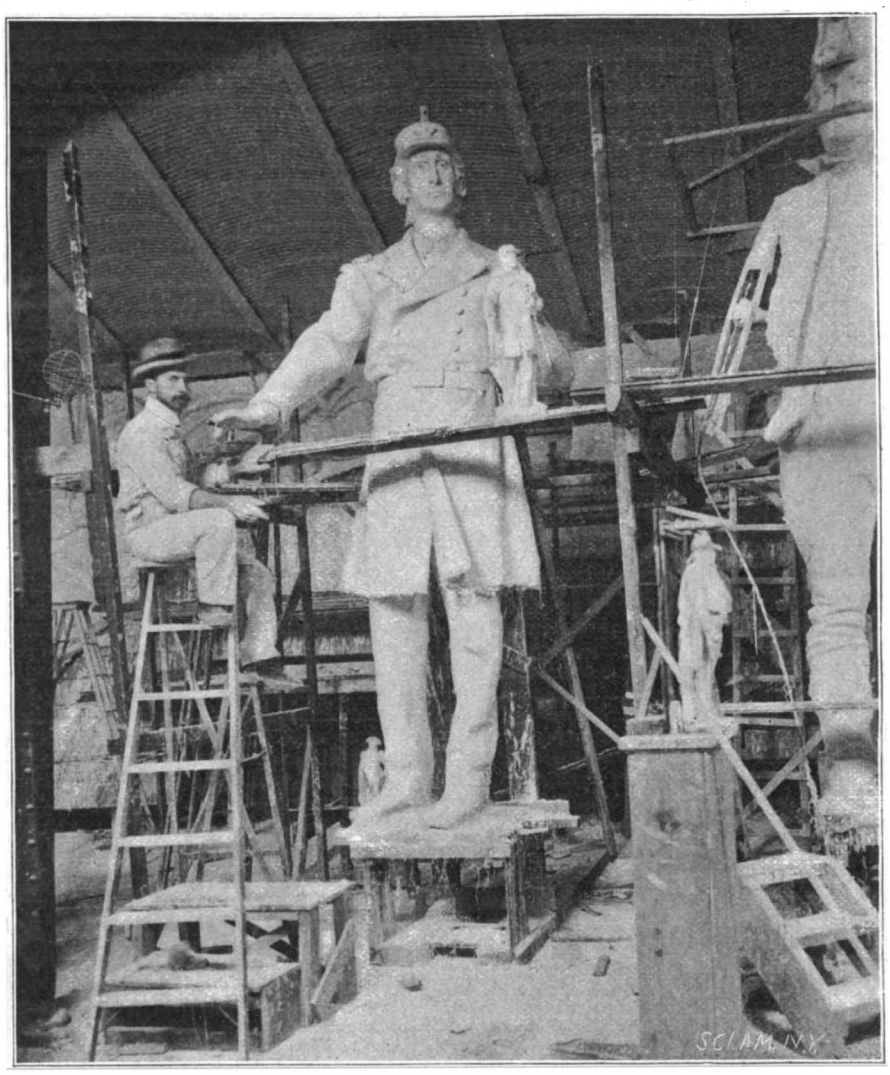
Madison Square was the logical place for the arch. Twenty-fourth Street was taken as the axis for the arch, and the colonnade starts on the north side of Twenty-third Street and ends on the south side of Twenty-fifth Street. The plans were drawn with special care by Mr. C. R. Lamb and were approved by the sculptors and the Dewey committee.

The "Arch of Titus" at Rome was taken as being the best ancient example which could be richly decorated with sculpture, and it was modified to meet the special conditions. The Dewey arch was enlarged from the classic prototype, and instead of being supported on two piers, a new penetration was given east and west, the arch being deepened to one-half of the width in measurement, giving it four piers, and, therefore, adding much to its lightness. Extra columns have been added to the side, giving two groups of two columns each, thus making a motive for the colonnade. The arch is approached from the south by six double trophy columns arranged in pairs, three on either side, and the columns at Twenty-third Street and Twenty-fifth Street being reinforced by an extra column on either side, thus repeating the same effect of two columns when seen from the north or south. The first or south pair will have groups of statuary by F. W. Ruckstuhl, representing "The Army," and George E. Bissell "The Navy." Decorations by Herbert Adams will be placed on each double column.

The arch proper is about 70 feet wide by 35 feet deep, while the height from the roadway to the wreath in the hand of "Victory" will be 100 feet. The sculptural decorations of the arch are intended to symbolize our power as a maritime nation. The great groups on the front of the piers are the "Call to Arms" by P. Martini; "Battle" by Karl Bitter; "Return of the Victors" by C. H. Niehaus; and "Peace" by Daniel C. French. Above these on the attic acting as finials to the eight columns are full-length figures of heroic size of the great figures in American naval history, Commodore Paul Jones by E. C. Potter, Commodore Hull by H. K. Bush-Brown, Commodore Perry by J. S. Hartley, Commodore Decatur by G. L. Brewster, Commodore McDonough by Thomas S. Clarke, Admiral Farragut by W. O. Partridge, Admiral Porter by J. J. Boyle, and Cushing by A. Lukeman. The remainder of the attic is taken up by symbolic panels and inscriptions. The four spandrels over the main entrance have bas-reliefs symbolizing the Atlantic and Pacific Oceans on the north by R. H. Perry, and the North and East Rivers on the south by I. Konti. The keystones of the arch will be surmounted by eagles. Topping all is a quadriga with a winged "Victory," the most appropriate subject for the crowning feature of the arch. It is by the Society's president, J. Q. A. Ward. There are also reliefs flanking the arch and on the sides representing the "Progress of Civilization" by J. Gellert, and the "Protection of Our Industries" by W. Couper. Eight portraits of admirals are added as an enrichment to the spandrels of the smaller arches on the Twenty-fourth Street penetration. The upper end of the colonnade will have two large groups also.

It might well be asked how it is possible to build this enormous arch in the space of six short weeks. It only is rendered possible by that beautiful plastic material called "staff," which first came into prominence in this country at the Chicago Exposition of 1893. It is

DEWEY ARCH NOW BEING ERECTED IN NEW YORK CITY.



MODELING IN STAFF A HEROIC FIGURE OF LIEUT. CUSHING.

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a cheap substitute for more durable material, and presents a handsome appearance. It consists of plaster of Paris mixed with cement and fibrous materials. The arch proper is built of wood and looks not unlike a well built scaffold. This is being entirely overlaid with staff, and the figures will be placed in position at the proper time. Some of the larger pieces will be modeled directly in place, but most of the sculpture has been enlarged in the Madison Square Garden, where our staff photographer has been able to get some photographs of the animated scene by flashlight, for in the mad rush against time there is no chance for posing.

The sculptor makes his model in his studio, generally 2 or 3 feet high; he then obtains a plaster model from it, and this is taken to Madison Square Garden, where it is enlarged under the direction of Carl Beil, who had charge of the men who did the same work at the World's Fair. Usually the head and hands are modeled full size in the sculptor's studio. A wooden carcass is built to support the head and hands, and then the work of building up the man 12 feet high is begun. All of the trunk and legs are outlined with wire netting, the staff being applied over this. Pieces of wire cloth, burlap, and even excelsior are freely used. The plaster is brought in pans and is applied with trowels and coarse modeling tools. Drapery is readily obtained by using burlap dipped in the plaster. Some of the sculptors do their own work, others employ professional modelers. The proportions are kept with calipers and by means of plumb lines and scales which correspond to the ruled squares of a painter's cartoon. There is not very much finishing, except to face and hands, and the bodies are freely shaped with hatchets and rasps. Some of the figures were modeled full size, as in the alto-reliefs shown in one of our engravings; here the actual modeling clay and not the plaster is being used. A wooden framework blocks out the main masses and the clay is modeled directly on this. A small sketch a few inches high is of course made first.

The staff for the architectural part of the structure was modeled elsewhere, and the first piece was applied to the arch September 7. Admiral Dewey is certainly to be congratulated for the splendid trophy of victory, even though, a few days after the celebration, it will be only a memory.

THE Sanyo Railway of Japan has recently introduced dining cars, and sleeping cars are also to be run.

Amber in Eastern Prussia.

Amber is found all along the Prussian shores of the Baltic, but principally in the peninsula of Samland. All amber, found everywhere, is state property, but the state cannot mine amber without the permission of the owner of the ground. Before the beginning of the present century, digging was the only means employed for obtaining amber. It was done in an irregular manner, and in 1862 dredging was practiced. This was continued until 1890, when mining by means of shafts was also resorted to; diving has also been practiced with great success. Amber occurs in the so-called blue earth, a sandy clay with many grains of quartz and granite. In the dry state the earth is green, and when it is wet it becomes almost black. The blue earth is washed with water, the big lumps being reduced with the help of mallets, and passed over sieves, and the slime is returned to the sea. The shafts have a depth of from 30 to 60 feet, and further inland they may be double this depth. One mine has nearly a thousand employes. The inferior pieces of amber are made into what is called "ambroid." The pieces are washed and dried, coated on the outside with some chemical, and are then moulded with the aid of heat and pressure.

Our Trade with Africa.

Public interest in African affairs is very great at the present time, while that continent is in such an unsettled condition. Africa is regarded by many commercial nations as a great future market for exports, and the demand for United States goods is not at all backward. Exports from the United States to Africa were in the fiscal year of 1899 more than five times as great as they were in 1889, amounting in the former year to $3,496,505, and in 1899 to $18,594,424. From "Cape to Cairo" and from Liberia to Abyssinia American manufactures and American foodstuffs are steadily making their way into public favor, and the consumption is constantly on the increase. Railroad bridges in the Nile Valley, mining machinery in the gold and diamond districts, cloth and foodstuffs are all eagerly sought for. Exports from the United States to Africa have grown more rapidly since 1893 than those to any other of the grand divisions of the world, while Asia and Oceanica come next, and they are followed by Europe, North America and finally South America.

It is an encouraging sign that not only are our exports to Africa growing rapidly, but they are evidently taking the place, to a greater or less extent, of those articles formerly supplied by other countries. The British South African Export Gazette says "that American competition has to be met in all departments of trade. This competition is also not to be ignored because the shipments in many cases are small in quantity and value, as this is a peculiarity incidental to the opening of all new markets. The energy which our transatlantic cousins put into all of their new departures is earnest of a sufficiently active exploitation in the near future. This can only be met by renewed care and energy on the part of English firms in cultivating the South African markets."

The Current Supplement.

The current SUPPLEMENT, No. 1237, has a number of most interesting articles. "Notes on Manila and Cavité" describes some curious features of our new possessions. "Victoria Regia" is the subject of a large engraving dealing with this curious aquatic giant. "Archæological Discoveries at Carthage" refers to the important discoveries which have recently been made upon the site of one of the most interesting cities of antiquity. There are a number of articles devoted to trade besides the regular consular page. "Manufacture of Carbons" describes most ingenious automatic machinery for plating the carbons and presses and baking furnaces. "The Relations of Physics and Astronomy to the Development of the Mechanic Arts" is the conclusion of Prof. Abbe's interesting paper.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

HARROW.—CHARLES OHAVEN and FRED P. UHRIG, Fort Madison, Iowa. This clip-guard harrow-tooth holder has a solid front recessed for the reception of the tooth and adapted at the same time to strengthen and hold the tooth fast in place. The clip-guard is drawn together by means of a bolt and nut at the back of the bar through holes made for the bolt in the ends of the clip combined with the bar, tooth and bolt. This device differs from tooth-holders made of two pieces and bolted together at the back of the bar, as these give an opportunity to the clip to spring from its work and loosen the tooth.

Bicycle-Appliances.

AUTOMATICALLY-OPERATED BICYCLE-PUMP. JOHN S. BUBB, Kittanning, Penn. This invention provides improvements in bicycle-pumps connected with the bicycle frame and adapted to be conveniently shifted into and out of operative position by the rider while mounted on the machine. In its essential features the invention comprehends a novel construction of pumping and distributing mechanism adapted to be disposed within the frame-tubing, and so arranged as to be operated by an eccentric of crank-mechanism connected with either the drive-wheel axle or the crank-axle.

Electrical Apparatus.

ELECTRIC METER.—ALBERT PELOUX, Geneva, Switzerland. The invention provides an electric meter of the motor-type, in which a motor system moves a metallic disk or cylinder. The disk, in turning between the poles of permanent magnets or electromagnets, acquires a speed of rotation in proportion to the electric energy expended. The meter has the merit of dispensing with movable wires upon the armature, thus making an exceedingly strong apparatus, as the movable part consists only of a spindle, two iron cores, a disk, and a movable brush. The meter may be employed for a three or five-wire system.

ELECTRIC SWITCH.—ALBERT E. WELLS, Pittsfield, Mass. The electric switch has a terminal-block box provided with a cover having a slot registering with a slot in one side of the box proper. A two-armed shutter within the box has one of its arms pivoted on the inside of the box, the arms of the shutter being adapted to close the slots. This switch is simple in construction, positive in its action, large in capacity, and is arranged to insure a simultaneous breaking of all points in a circuit, and to reduce the arcing to a minimum.

VISUAL SIGNAL APPARATUS.—RUDOLF EINBIGLER, Manhattan, New York city. The invention provides an electrical signal device particularly adapted for use in offices or buildings, and comprises a series of main annunciators placed in a suitable position and upon the inner or normally-hidden side of each one of which is placed a numeral designating a person to be called. In connection with each one of the main annunciators an auxiliary annunciator or a series of auxiliary annunciators is provided, electrically operated and controlled from various points of a building or the like, remote from the main board, so as to indicate the calling person to the person called.

Engineering-Improvements.

CUT-OUT COCK FOR ENGINEERS' VALVES.—DENNIS BROWN, Somerset, Ky. This cut-out or stop-cock is especially designed for use when a number of locomotives are coupled to a single train, the arrangement then enabling a connection to be established between the train-line pressure and the train-pipe gage, so that each engineer can see what pressure is in the train-pipe and what is drawn off by the engineer of the leading engine. Should the leading engine not charge or control the brakes, the engineers of the other locomotives can instantly charge and handle the brakes.

GOVERNOR CUT-OFF.—MARTIN O. ARNEGAARD, Hillsborough, N. D. The governor cut-off is an improvement on a similar device patented by the same inventor. The novel features of the present invention are found in the construction of the pivoted bar forming a flexible downward extension of the vertically-slidable governor "shaft" or bar, in the tension adjustment for the spring-counterbalance for the governor shaft or bar, whereby the speed of the engine may be changed at will without materially affecting the sensitiveness of the governor, and in the improved attachment of the governor-arms to the cross-head of the sliding shaft or stem.

Mechanical Devices.

WAVE-MOTOR.—WILLIAM A. NORTON, Port Richmond, Richmond, New York city. The wave-motor comprises two connected floats, on one of which a rock-shaft is mounted operatively connected with the other float. Gear-wheels have clutch-connection with the power-shaft and are engaged by racks operated alternately in opposite directions by the rock-shaft. A water-motor is connected with the power-shaft. Mechanism actuated by the rock-shaft supplies water to the motor. The waves rock the floats, thereby operating the racks to impart motion to the power-shaft. At the same time water is supplied to the motor. The rack-and-gear motion is designed to start the operation.

STENCILING-MACHINE.—STUART B. MOORE, Brooklyn, New York city. In shipping goods it is always desirable to stencil the address. But to use metal stencils for each shipment would be too costly. It is therefore desirable to be able to make paper stencils which shall last a reasonably long time. A machine for forming such stencils is provided by the present invention. The machine comprises two superposed connected disks respectively carrying dies and punches adapted to receive the stencil-sheet between them. An index plate or disk is fixedly secured to the punching-disks and is carried above the frame. The disks are pivoted to rotate upon a block reciprocated with the disks in the guideway of a frame.

BOX-SEALING MACHINE.—JOSEPH T. CRAW, Jersey City, N. J. This machine is adapted to seal the flaps of paper boxes after the boxes have been filled and is of such simple construction that the boxes may be conveniently manipulated by a single operator. The invention provides for the distribution of cementing or gluing material to the portions of the flaps to be sealed. The cement or glue is automatically applied and the flaps folded to a sealing position. The operator has merely to feed the filled boxes to the machine.

AUTOMATIC LATHE. LUCIUS A. CARSON, Hopedale, Ohio. The object of this invention is to provide an improved lathe designed for automatically turning, boring, sawing off, and completely finishing small articles of wood. The lathe comprises a support for a stick. The stick is moved in the support by a spiked wheel which can be rotated intermittently in opposite directions and through different distances. The stick can be held in the support against accidental movement, and can be operated upon by various tools in the different positions to which it is moved.

COMPUTING-MACHINE.—JOHN J. WALL and HERMAN ROGALSKY, Buhler, Kans. This invention provides for the use of merchant and custom millers, a convenient computing-machine for the purpose of finding out at a glance how many pounds of flour or feed are to be given in exchange for a certain amount of bushels or pounds of wheat at a certain number of pounds to the bushel, thus saving much valuable time in computing and also avoiding the possibility of error in separately figuring the accounts.

HOOP-MACHINE.—JAMES FOWLEY, Cobden, Ill. This machine makes barrel-hoops directly from the log, with one end tapered to a thin edge to form the lap and the other end pointed to form the outer wrap. With the vertical or slicing saw are connected a series of five vertical cutter-heads arranged in front of the saw, one set having relatively stationary bearings and the other set having respectively blades with V-shaped cutting edges and plain blades, means being provided for giving them an automatic motion to and from the log to form pointed ends and bevel-faces on the opposite ends of the log.

ANIMAL-TRAP.—WILLIAM H. HARDEN, Quitman, Ga. The self-setting trap has an entrance-compartment connected by a passage with a second compartment. In the passage is a tilting platform. A gate controls the opening of the passage into the second compartment, the platform tilting into and out of register with the gateway of the gate. Connections between the gate and the tilting platform cause the platform to open the gate as it moves into register with the gateway. A clock-mechanism readjusts the tilting platform. The various operations described are effected by the animal as it seeks to escape.

MOTOR.—EDGAR L. GARVEY, Gainesville, Tex. The present invention provides a fan or like motor in which the energy is stored up by a spring and conserved efficiently. Operatively connected with a rotatable spring-carrying and spring-actuated drum is a train of gear-wheels which drive a shaft. A pinion is splined on the shaft and is adapted to slide thereon in order to engage the different gear-wheels to vary the speed.

RATCHET-MECHANISM.—LOUIS P. WELLMAN, Taurus, N. J. This mechanism is designed to convert reciprocating into rotary motion. The ratchet-wheel has teeth provided with sloping side surfaces. An operating lever is provided formed in two separable halves having a common pivot and drawn together by connecting springs. The tooth-engaging ends of the lever have their inner ends beveled and slightly rounded at the corners. The device is particularly designed for use with mechanisms driven by the reciprocation of the feet or hands.

MACHINE-GUN.—Hon. EDWIN M. CAPPS, San Diego, Cal. The invention relates to improvements in rapid-firing machine-guns; and it refers particularly to guns in which the barrel and firing mechanism are arranged to operate in conjunction with the cartridge-holders, having a series of cartridges arranged to be successively fed into a firing position. The invention provides a novel barrel and firing mechanism and automatically-fed cartridge-holders designed to fire any of the ordinary forms of military cartridges in which premature firing is rendered impossible and in which non-explosion will not impede the firing action of the gun. The invention also furnishes a novel method of sighting by means of stadia measurement.

Miscellaneous Inventions.

PACKING-CASE.—THOMAS MILLER, Jr., and WILLIAM O. JOSLIN, Springborough, Ohio. This invention seeks to provide a knock-down tobacco-case with a simple fastening device for securing the several parts together and so arranged that there are no projections to prevent several cases from being packed closely together. The end-pieces of the case have cleats on the inner side. The top, bottom, and side pieces have also cleats on the inner side. Through openings in the cleats fastening bolts pass, each consisting of sections arranged at right angles to each other. A shoulder on one of the sections engages the inner side of the case; and nuts engage the screw-threaded portions of the bolts. By loosening the nuts on the sides, the case expands and can then be readily lifted from its contents.

DUST-CART.—FRANZ LOOS, Carlsbad, Austria-Hungary. The cart can be filled without causing unpleasant dust and can be automatically dumped at the desired place. A special feature of construction is a portion forming a dust-inlet and having a sliding bottom and a sliding cover, both connected with a bell-crank lever whereby they are operated. Swinging on the cart is a dust-box having a sliding cover, which dust-box is capable of being connected with the sliding bottom, the cover of the box being engaged by the bell-crank lever.

WAGON-STANDARD.—REINHOLD KLATT, Strong City, Kans. The standard has a body and base, the latter being provided with a downwardly-extending marginal flange inclosing the end of the bolster. Fastening devices are passed through the bolster and the base of the standard. A strap is fastened down on the top of the bolster and has engagement with the base of the standard. The standard does not in any way weaken the bolster to the extent necessary in the application of the ordinary standards.

ACETYLENE GAS MACHINE.—JACOB D. KAUFMAN, CHARLEY B. TITUS, and ADNAH E. VANARSDALE, Little River, Kans. It is the object of this invention to provide an acetylene-apparatus having a large carbid capacity and so arranged that the generator is completely surrounded by water, thus keeping the gas cool. Within the gasometer the generator is arranged. Removably placed in the generator are carbid-holders, each having a perforated top or cover through which water is passed. A gas-pipe leads from the lower portion of the generator and upward into the gasometer and has a portion coiled around the generator. Distributing and blow-off pipes are provided.

SHADE-FRAME.—FRANKLIN E. HOWARD, Buffalo, N. Y. This shade-frame for electric lamps has supporting-arms adapted to engage the lamp. To the arms a continuous ring is attached having tapering sides on which the shade is supported. A continuous flange is projected upwardly from the inner edge of the ring and is capable of yielding inwardly to admit the shade to the ring. The flange stands out normally to hold the shade in place.

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ELEVATOR-CARRIER.—EGBERT J. HOOKER, Poultney, Vt. The present invention provides a carrier adapted for use in quarries, which carrier is so constructed that it will travel on an elevated track or cable at any desired speed, it being possible to stop the carrier at any desired point on the cable or track. The brake used for the carrier does not in the least interfere with the cable or track and operates independently of the cable. The parts are so constructed that when the load is in dumping position, the carrier will be automatically held stationary.

EXERCISING DEVICE.—ABRAM A. HENDRICKSON, Jamaica, Queens, New York city. This invention provides a novel handle for exercisers, consisting of a handle-bar having a frame upon which a finger-bar is adapted to slide longitudinally, the elastic cord being attached to the bar. The handle-bar is held in the palm and the fingers are passed over the finger-bar. In operation, the finger-bar will be alternately moved back and forth under the action of the cord and of the fingers. The device possesses the merit of exercising the fingers as well as the arm.

HAND-STAMP.—HENRY H. HARRISON, Manhattan, New York city. This invention provides a hand-stamp for making reproductions from copying-ink, the printing surface being formed of a plastic or viscous compound mounted or run into the proper form and then permitted to set. The stamp has a body curved in the arc of a circle and provided with a handle-bar running between its ends, so that the stamp may be held in the hand, and its arc-shaped printing surface rocked over the surface to be printed, all of which provides a much more effective and expeditious arrangement than that in which the surface to be printed is laid down on a stationary printing pad or form.

EXTENSION-TABLE.—WILLIAM R. HALLETT, Hamburg, Ill. The inventor has devised a table provided with simple means for automatically raising the intermediate leaves into place while the table is being extended, and for lowering the leaves while the table is being shortened. The table comprises two frames mounted to slide one relatively to the other. To each frame a table-top section is rigidly secured. Plates are mounted to swing on the inner surface of one of the frames and are engaged by intermediate leaves. Rock-bars have cam ends engaging the plates; and from the rock-bars yielding tappets extend down and are engaged by a cross-bar carried by one of the frames.

ORE-CONCENTRATOR.—HENRY C. GRANNATT, Colorado Springs, Col. In the frame of the concentrator are a series of slats pivoted at their lower edges, each having a riffle extending along its pivoted edge. The slats are placed in successively lower planes so that the overflow from one is received by the next. The riffles extend from the feeding end of the slats a part only of their length and are of successively greater length. The frame can be reciprocated longitudinally of the slats; and the slats are simultaneously given a slight oscillation on their pivots. The device may be used in places where the supply of water is limited.

DEVICE FOR TEACHING MUSIC.—JOHNSON MORRIS, Marshall, Tex.—The purpose of the inventor has been to provide an improved mechanical device whereby simple music in any key can be readily taught. The device comprises a modulator provided with columns containing characters indicating every semitone and tone within the tonal compass of the modulator, and also provided with rows of hooks adjacent to the characters. A tone-ladder is provided with arms to engage the hooks and to indicate the steps in the diatonic scales of the characters in the columns. Independent arrows are provided to indicate the tones contained in any desired scale or chord.

SEA-GOING RANGE-FINDER.—JOHN DONEGAN Cincinnati, Ohio. The range-finder comprises two telescopes arranged in the same horizontal plane, one of the telescopes being pivoted to swing relatively to the other. A cylinder extends longitudinally of the telescopes and turns in unison with the swinging of the pivoted telescope. The cylinder is provided with rows of numerals indicating distances which can be read by a longitudinally-extending fixed bar. An indicator at the rear end of the cylinder indicates the row of numerals on the cylinder on which the distance is to be read. This indicator comprises a fixed disk having graduations corresponding with the graduations of the fixed bar. A pointer moves on the disk in unison with the cylinder and pivoted telescope.

COMPOSITION OF MATTER.—GUSTAV T. BRUCKMANN, Brooklyn, New York city. The purpose of the present invention is to provide a means whereby an oxygenated agent may be added to hydrogen peroxid in sufficiently large quantities to preserve the peroxid without producing the disagreeable and painful effect on the tissues incident to the use of mineral acids. To this end the inventor employs carbon dioxid, which disappears largely at the time the peroxid is medicinally used, and is present in large quantities only so long as its preserving action is required.

STRAP-PROTECTOR.—EDWARD G. AWCOCK, New Orleans, La. This simple, metallic, protective device for harness is entirely independent of the strap to which it is applied. The device is adapted for connection with a buckle and for receiving a ring, snap, or other connecting medium between straps in a harness. The loop-attachment of a buckle to a strap need not be depended upon for security. The connections between the straps will not wear the leather.

WRENCH.—ALEXANDER ANDERSON, Greenville, Miss. The novel feature of this invention is found in a peculiar nut, slidable on the shank when in one position and locked against sliding when in another position, so that the jaw in one case can be moved, while in the other position it is locked against movement. The jaws are so arranged that they cannot readily become disarranged, and that they can securely grip an object without danger of the movable jaw's slipping or losing its hold on the object.

CONCENTRATOR.—JOHN C. and RICHARD C. WATERS, Romley, Colo. On a vertically-sustained pivot a head is mounted to rock. Two relatively adjustable arms are attached to and extend oppositely from the head. A third arm is secured to the head, and extends between the two first-named arms. On the three arms a segmental table is mounted which is adjustably supported at its outer edge. A curved trough is secured at the inner edges of the table adjacent to the pivot; and a flange is located at one edge of the table adjacent to the trough, the opposite edge of the table being adapted to discharge the concentrates, and the curved trough being adapted to receive the tailings.

COMBINED ADVERTISING-CABINET AND BOOKCASE.—WILLIAM F. PATTON, Akron, Ohio. This device is designed for use in hotels and other public places and is arranged to display advertisements effectively and to contain books of reference. The bookcase used is provided with receptacles for books and has an advertising space at its front. Wings at the sides of the bookcase are arranged for displaying advertisements, are connected by hinges with the sides of the bookcase, and are adapted to be swung forward or rearward into angular positions relatively to the bookcase. A cap for the top of the bookcase is provided with advertising-spaces.

MAIL-BAG.—LOUIS SANDERS, Brooklyn, New York city. This invention provides a mouth-controlling and mouth-locking device which will effectually hold the mouth of the bag open to receive letters and packages and which will also hold the month closed. The mechanism at the mouth of the bag can be quickly operated. A receptacle is also provided for the destination-card, in which receptacle the card is automatically retained when the controlling mechanism is locked, and released when the mechanism is opened.

CHANGE-MAKER.—PETER P. MCMENAMIN, Jersey City, N. J. This invention provides an improved change-maker to enable cashiers and bartenders to make change quickly and correctly and to prevent so far as possible the occurence of errors when paying out money or changing bills or coins of higher denomination. The change-maker is provided with cells for containing stacks of coins. Under each cell is a single slide for moving the bottom coin from under the stack. Each slide is manually operated and is arranged to be moved independently of the other slides. A series of slides can be mechanically operated at the same time.

SHIRT-BOSOM HOLDER.—CHARLES L. PASHLEY, Stamford, N. Y. In order to secure the opposite edges of a bosom to a vest so that the vest cannot spread and bend the shirt-bosom, the inventor provides a plate having prongs at one end for attachment to the vest, and a hook at the other end. The plate is extended inwardly from the edge of the front opening. A loop engaging the hook is removably connected with the shirt.

PACKAGE FOR INCANDESCENT-MANTLES.—HENRY ANHALTZER, Manhattan, New York city. The package comprises a casing, to the bottom of which a support for the mantle is secured. A supporting-bar extends through a loop at the top of the mantle and has its ends sprung into the upper portion of the casing, after which the casing is filled with collodion, alcohol, or ether. A mantle thus packed can be safely transported.

BATING PROCESS.—HENRY SCHLEGEL, Lapeer, Mich. After hides have been unhaired and before they are tanned, they are subjected to a "bating" process by which the lime is removed. Various acids have been used in the process, but bating has always required much care and skill. The inventor of the present process secures a simple bate by employing a solution consisting essentially of potassium bichromate.

DUST-GUARD.—JAMES S. PATTEN, Baltimore, Md. The guard is composed of sections of sheet metal slidable with relation to each other and having opposite, curved edges provided with integral bent portions forming seats for packing-strips. The guard can be cheaply constructed. The wearing parts can be readily renewed.

FOLLOWER FOR PACKING BARRELS.—NORRIS M. ROOT, Masonville, N. Y. This invention provides improvements in devices for packing or holding meat, pickles, fish, or the like, under brine in a barrel. The follower used for this purpose is easily adjusted to the varying diameters of a barrel and has no metal parts to corrode. The follower comprises a disk or plate having guide-strips extended in opposite directions, which strips have longitudinal slots provided with notches in their lower walls. Holding-arms and cross-heads on the arms project into the slots, one thickness of the portions of the cross-heads being substantially equal to the distance between the walls of the slots, and the thickness at right angles to the first-named thickness being greater than the distance between the walls of the slots.

COPY-HOLDER.—LOUIS HUDGIN, Lochiel, Arizona. This holder rests on the desk of a typewriter and holds the copy in an inclined position over the machine and directly in front of the eyes of the operator. It consists of a rectangular vertical support frame hinged to foot pieces which are fastened to the desk, and having two pairs of hinged arms projecting out at an angle from its front face, one pair being at the center of the frame and the second or shorter pair projecting from the top. These arms carry the copy-holder, which may be adjusted in position. The copy-holder has been designed with the especial object of doing away with the necessity of fastening the device to the desk or machine.

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(Continued on page 190)

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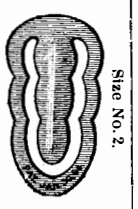
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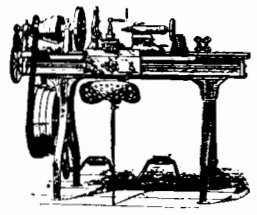

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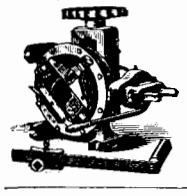
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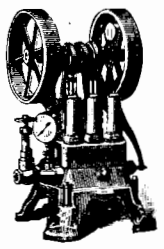
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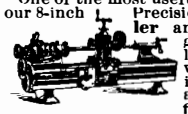
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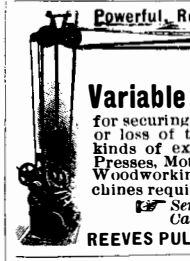
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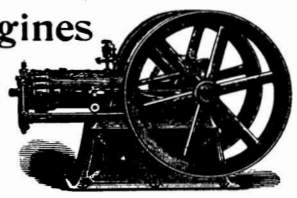

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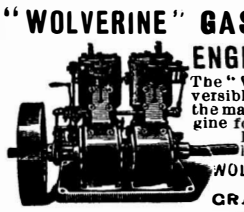

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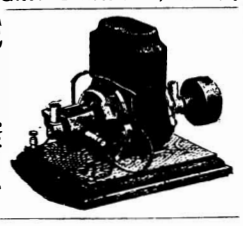

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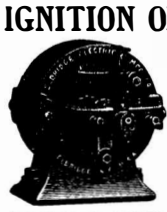

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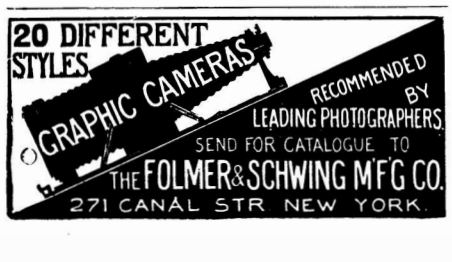
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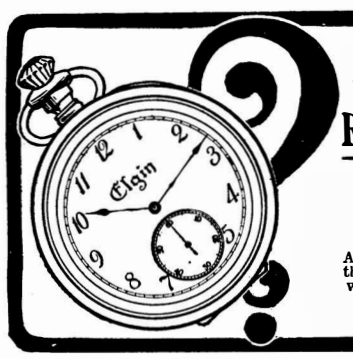

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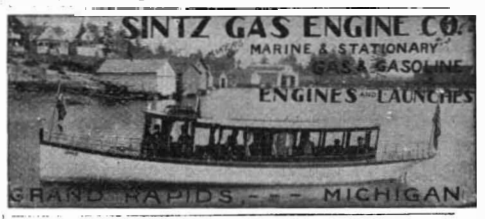

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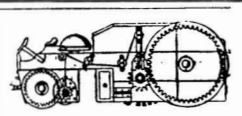

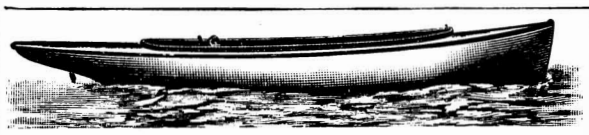

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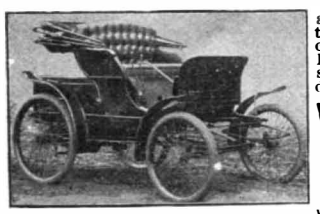

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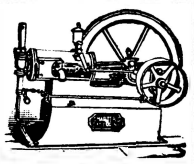

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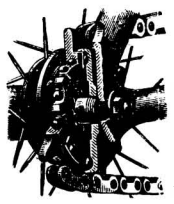

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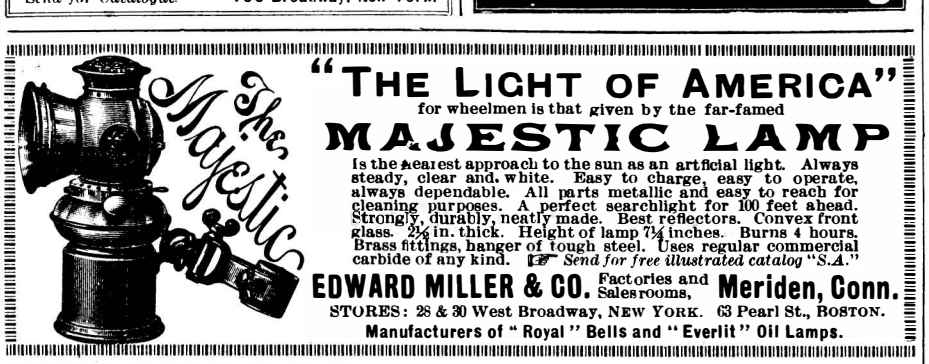

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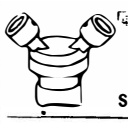

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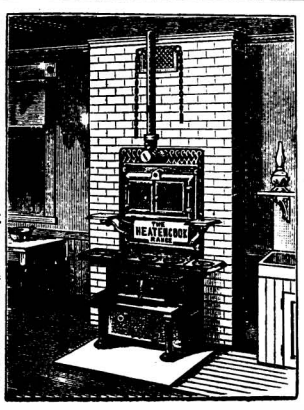

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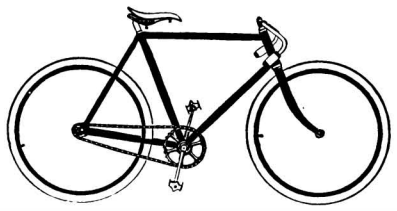

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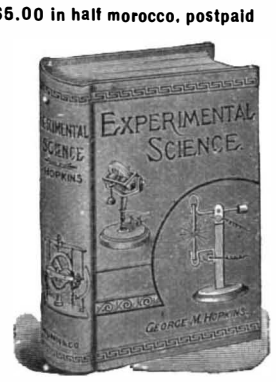

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